BOGATU CRIȘAN

CURS DE LIMBA ENGLEZA

EDITURA UNIVERSITĂȚII BUCUREȘTI
1995

BOGATU CRIŞAN

CURS DE LIMBA ENGLEZĂ

EDITURA UNIVERSITĂŢII BUCUREŞTI
-1995-

Referenţi ştiinţifici: Conf. dr. CRISTIAN MĂRUNŢEANU
Lector ELENA DRÂMBĂREANU

ISBN – 973 – 575 – 040 – 6

GEOLOGY

LESSON I

THE ORIGIN OF THE EARTH

The strata of the earth reveal its history with great fidelity for periods previous to the present, but earlier than that the record becomes indistinct, and if we attempt to follow it back to the beginning, the indistinctness merges in to extreme obscurity. The rocks at the base of the known sedimentary series are so greatly disrupeted, crumpled, crushed, metamorphosed, and travetsed by intrusions, that their history is deciphered with the greatest difficulty and no little uncertainty, while below these lies the inaccessible interior of the earth whose formation constituted a still earlier chaoter in the history. The nature of this inaccessible mass can only be inferred from vulcanic extrusions, the transmission of seismic tremors, the phenomena of gravity, the distribution of rigidity and of internal heat, the modes and processes of deformation, and other phenomena of a more or less dynamic kind. All these phenomena have their bearing on the problem of the earth´s origin, but just what they imply cannot yet be interpreted without some measure of reasonable doubt.

Besides these internal phenomena, suggestions relative to the origin of the earth are to be found in its characteristics as a planet, and in its relations to the other membrs of the solar system. Suggestions are also to be found in certain certain geatures of the solar system which show that it had no haphazard origin. The birth of the system is beyond doubt revealed in its constitution and in its dynamics,

if one could but read the record. But all these phenomena of external relations, as of the hiden interior, are difficult to interpret, and the meaning they carrey cannot be read as we read the sedimentary record. We do read dynamical records. In the fall pf rain we readily read the previous ascent of vapor, not so much by any matyerial record as through a known system of atmospheric dynamic. We readily follow the growth of an eak back to its origin by reversing its organic processes. By three observations of the apparent positions of a new comet, the astronomer treces its path backward and forward. In a somewhat similar way, the history of the earth will doubtless in time be traced to its beginning through its dynamical characters. It is quite certain that the earth and the solar system were organized in pursuance of a definite succession of progressive changes which are virtually recorded in the phenomena of the present stage. When a fuller and deeper insight into such phenomena is attained, the record will doubteless become quite readable, and the interpretation sure.

Whitle aeaiting this, we must be contebnt with hypotheases. Since these are our only resource, there is need to form as clear conceptions as possible of those hypotheses that have been or may be entertained, and of their working qualities as applied to the problems of the earth. It is no less important to acquire at the same time a hospitable and intelligent preparedness to appreciate new light as it shall present itself.

Not a few of the doctrines of geology, when traced back to their ultimate terms, are found to hand on some hypothesis of the earth´s initial stage, and to have no greater strenght than that hypothesis. It is therefore important to scrutinise these basal hypotheses, to note critically the ways in which into the various geological doctrines, and to carry into the study of earth-history a never-failing sense of these hypothetical dependencies. This should serve as a wholesome guard against the acceptance of conclusions as substantiated, when they are in reality hypothetical in their ultimate dependence; especially should it guard against the *unconscious*

acceptance of conclusions as though they were demonstrated, when in reality, traced a step or two backward, they may be found to be grounded solely on a hypothesis.

It is the glory of geology that it is a growing science. While it has an enormous mass of the firmest data, and its great conclusions rest on most substantial grounds, and it will never be radically changed by any developments in the future, it has, at the same time, many problems that are yet unsolved, many doctrinesc that are yet debatable, many depths that are yet unfathomed. At all points, therefore, it invites an investigative spirit: it courts an attitude of independent thought and of critical scrutiny. Especially is this true of the hypotheses of the origin and early states of the earth, to which we now turn.

Words and phrases

Previous to the present = înainte de prezent
to follow it back = a urmări în trecut
no little uncertainty = nu fără mare nesiguranţă
a still earlier chapter = un capitol şi mai timpuriu
more or less = mai mult sau mai puţin
have their bearing on the problem = au legături în problema
whthout some measure of reasonable doubt = fără un anumit grad de îndoială justificată
beyond doubt = fără îndoială
haphazard origin = origine întâmplătoare
if one could but read the record = dacă cineva ar putea citi cele înregistrate
will doubtless never become quite readable = va deveni fără îndoială uşor de citit.

EXERCISES

I. *Answer the following questions:*

- What do the strata of the earth reveal ?
- How are the rocjs at the base of the sedimentary series ?

– What helps us to infer the nature of the inaccesible mass ?
– Where are suggestions relative to the origin of the earth to he found ?
– Why is it necessary to know the origin of the earth ?
– Why is it important to scrutinize the basal hypotheses ?
– What is the glory of geology consisting in ?
– What is it based on ?

II. *Give the Romanian translation and build up sentences with the following words:*

disrupt, crumpled, crushed, intrusion, lie, extrusion, yet still

III. *Give synonyms of the following words:*

to bear, io carry, readily, way, to trace.

IV. *Give the English equivalents for the following Romanian combinations:*

a purta o greutate, a purta armele, n-a mai putu suporta aceasta, a purta o conversaţie, şi-a continuat discursul, s-au efectuat cercetări, a duce la bun sfârşit o însărcinare.

V. *Give antonyms of the following words formed by adding negative affixes. Translate them:*

known, used, usually, necessary, sense, distinct, definite, light

VI. *Translate into Romanian:*

Not a few of the doctrines of Geology, when traced back to their ultimate terms ars found to hand on some hypothesis of the earth´s initial stage, and to have no greater strenght than that hypothesis.

The priciple of identifying the ages of strata by their fossils has now been firmly established all over the world. Strata in Europe and Australia, for exemple, are now known to be practically contemporaneous if they contain similar suites of fossils. The time rquired for the migration of a particular species from one region

to another does not introduce any particular difficulty, because the intervals represented by even the smallest divisions of geological time run into hundreds of thousands or even millions of years.

VII. *Translate into English:*

În aceste condiţii nimic nu se opune să considerăm că, la o anumită dată, indiferent dacă aceasta a fost chiar la început sau într-o fază ulterioară, pământul era un corp format dintr-o masă fluidă, cu lumină proprie, în care materiile componente, în stare de fuziune, erau dispuse în ordinea densităţii: cele mai uşoare la suprafaţă, iar spre interior din ce în ce mai dense, până la centrul unde trebuia să se găsească substanţele cu densitatea cea mai mare. Această stare a durat până în momentul în care, în urma necontenitelor pierderi de căldură prin radiaţie, pământul a prins la suprafaţă o crustă solidă. Din acel moment el a pierdut lumina proprie şi a trecut de la faza stelară, la cea planetară.

LESSON II

HYPITHESES OF THE EARTH´S ORIGIN

It is the nearly unanimous conviction of astronomers that the solar system was evolved in *some* way from a nebula of *some* form, Until recent years, the majority of astronomers accepted the special theory of Laplace, presently to be sketched. So general has been this acceptance that the theory of Laplace has come to be known as „The Nebular Hypothesis", and when this phrase is used without qualification, this particular hypothesis is usually meant. The advance of inquiry, however, makes it necessary now to consider at least two other hypotheses, each of which postulates that the solar syspem arosa from a nebula whose constitution and mode of evolution differed from that postulated by Laplace. In a broad sense, all these are nebular

hypotheses. Each of them embraces sub-hypotheses or variations, but in their basal features are distinct and from three definite classes.

I. *The gaseous hypothesis.* In this, the parent nebula is assumed to have been formed of gas aggregated by gravity in accordance with the laws of gases, and to have beeen evolved into the present state by a gradual passage from the original system of gaseous dynamics into the present system of planetary dynamics. The type of the class is the Laplacian hypothesis.

II. *The meteoritic hypothesis.* In this, the parent nebula is assumed to have been a swarm of meteorites, the individual members of which moved in diverse directions and suffered frequent collisions, attended by heat, light and vaporization. The type is the conception worked out by G. H. Darwin, in which the swarm of meteorites is thought to have behaved essentially as a coarse gas, the evolution of the system being dynamically like that of a gaseous system: indeed, the initial meteoritic aggregation may have actually passed, at a later stage, into a gaseous one by the vaporization of the constituent meteorites.

III. *The planetesimal hypothesis.* In this, the constituents may be molecules or small masses of any kind meving in orbits about a common center. They are not primarily controlled by collision and rebound as in the oreceding cases, but by revolution about their common center of gravity or some central body, as are the planets to-day. In other words the constituents are infinitesimal planetoids or planetesimals. Under this hypothesis the dynamical system was essentially the same at the outset as is now; the evolution has consisted in the aggregation of the planetesimals into planets and satellites. Dynamically considered, it differs more from the other two hypotheses than they do from one another, but it is liable to be confused with the second, from which, however, it departs fundamentally. These three hypotheses will be considered in detaol.

Word and phrases

it is the nearly unanimous conviction = este convingerea aproape unanimă
in some way = într-un fel
until recent years = până în ultimii ani
presently to be sketched = ce urmează a fi schiţată în curând
has come to be known as = a ajuns să fie cunoscută a ...
at least = cel puţin
in a broad sense = într-un sens larg
swarm of meteorites = puzderie (multitudine) de meteoriţi
attended by heat, lught and vaporization = însoţite de degajare de căldură, lumină şi vaporizare
is thought to have behaved = este considerată că a acţionat
but it is liable to be confused = dar ea este supusă de a fi confundată.

EXERCISES

I. *Answer the following questions:*

– What is a hypothesis?
– Which are the main hypotheses of the earth´s origin?
– Who was Laplace?
– What is Lapalace´s theory?
– Was was G. H. Darwin?
– What was Darwin´s conception of the earth´s origin?
– What is the planetesimal hypothesis?

II. *Ask questions to which the following relies may be given:*

– The advance of incuiry
– It is the nearly unanimous conviction of astronomers.
– Ench of them embraces sub-hypotheses or variations attended by heat, light and vaporisation.
– Dynamically considered, it differs more from other two hypotheses.

III. *Give synonyms for the following words:*

broad, feature, distinct, to be assumed, in accordance with, to be thought to.

IV. *Puild up sentences with the following words:*

therefore, that is why, future, next, to accept, to agree.

V. *Fill in the blanks with suitable words from the text:*

Under this ... the dynamical system was essentially ... at the outset as it is now; the evolution has consisted... of the planetesimals into planets and... Dynamically considered, it ... more from the other two hypotheses ... they do from one ... but it is liable ... with the second, ... however it departs fundamentally.

VI. *Translate into English the correctly modal (defective) verbs:*

tu poţi folosi stiloul meu; Ştii să vorbeşti englezeşte? Pot intra? Ceasul trebuie să fie înainte. Puteai scrie englezeşte anul trecut. Trebuie să ştii. Fiecare ar trebui să vadă acest film. Ar fi trebuit să fie aici. Deci nu ai putea termina? Nu aveam voie să intru.

VII. *Translate into Romanian:*

Turning from its external relations to the earth itself, a natural threefold division is presented: the atmosphere, the hydroshere and the litosphere. The armosphere and hydrosphere are reather envelopes or shells than true spheres, though is some degree both penetrate the litosphere. The litosphere on the other hand is a nearly perfect oblate spheroid with a polar diameter of 7899,7 miles and an equatorial diameter of about 26,8 miles more. The oblateness of the spheroid is an accomodation to the rotation of the earth, the centrifugal force at equator being sufficient to causa the specific amount of bulging there.

VIII. *Translate into English:*

În anul 1796, Pierre Simon Laplace, fără a fi avut cunoştinţă de ipoteza lui Kant, a emis, în ce priveşte naşterea sistemului solar, aşa numita ipoteză a nebuloasei, ipoteză întrucâtva asemănătoare celei

precedente, din care cauză este confundată cu aceasta şi cunoscută de obicei, sub numele de ipoteza lui Kant-Laplace.

În explicarea formării sistemului nostru solar, Laplace pleacă de la premisa existenţei iniţiale a unei mase gazoase imense, de un diametru care depăşea marginea externă a spaţiului ocupat astăzi de corpurile ce fac parte din sistemul nostru planetar. Această masă s-a contractat progresiv şi sub influenţa mişcării de rotaţie de care era animată, mişcarea ce devenea cu atât mai accelerată, cu cât se contracta mai mult, lua o formă lenticukară din ce în ce mai turtită, aşa cum se ştie astăzi că există astfel de nebuloase, dar de a căror existenţă Laplace nu avea cunoştiinţă.

LESON III
VOLCANISM

The great example of ascensive action is the movement of fluid rock from the interior outwards. The term volconism will be used to embrace not only volcanic phenomena in the narrower sense, but all outward forcing of molten material, whether strictly extrusive or merely ascensive.

The philosophy of this ascensive action, taken as a whole, is simple. In the effort at concentration under the powerful action of the earth´s gravity, the material of high specific gravity is urged mors strongly toward the center, volume for volume, than that of less specific gravity, and as gravity is nerpetually active, it follows that whenever any movement, molecular or molar, takes place which permits a readjustment of the position of the two kinds of matter, the heavier sinks toward the center and the lighter rises, or at least tends to do sc. So also where there are stress-differences, the mobile matter tends to flow from the regions of grater stress toward those of lesser stress. In so far as any portion of the interior becomes liquid, it is free to move up or down according to the balance of

stress brought to bear upon it, and adapts itself to any line of least resistance available to it. As a natural result, therefore, the portion of the interior which becomes fluid most largely participates in the outward movement. In so fas as molecular action permits a readjustment of material, there is a tendency, even in the solid state, for the lighter material to move upwards and the heavier downwards, and for the more stressed portions to move towards points of less stress; but this takes place with extreme slowness. In so far as the interior diffuse themselves through each other, the same laws hold good, but they are modified by the special principles that control diffusion. The outward diffusion of interior gases may be a factor of appreciable importance, but this cannot be affirmed at present.

Phases of volcanism. The fording of fluid rock outward assumes two general phases, which, hower, merge into each other; and these main phases take on various sub-phases. The first phase embraces those outward movements of fluid rock which do not reach the surface. The lavas, after ascending to the vicinity of the surface, intrude themselves into the outer formations of the earth and congeal underground (plutonic). The second phase embraces those outward mevements in which the fluid rock reaches the surface and gives rise to eruptive phenomena (volcanic). The first is *intrusive*, the second *extrusive;* the first constitutes *irruptions*, the second *eruptions*. The fundamental nature of the two is the same, but the extrusions usually take on special phases because of the relief of pressure at the surface of the earth, and because of the action of surface-waters in contact with the heated lavas. Just where the laves come from, and hiw they find their way through the deep-lying compact zone below the zone of facture, may better be considered later. When they reach the zone of fracture, they usually either take advantage of fissures already formed, or forde passage-ways for themselves by fracture. There is little evidence that they bore their way through the rocks

by melting, though they appear to round out their channels in some way into pipes, ducts and other tubular forms when they flow through then for long periods of time.

Volcanism and Phenomena associated with Volcanism

In some regions of current or recently past volcanic activity are found phenomena related to the volcanism. Belonging to this group are the widely known fumaroles, hot and geysers. In the course of consolidation either ar the surface or not far beneath the surface, gaseous emanations may be given off. These gas vents are called fumaroles. One of the most famous areas of fumaroles in the world is the Valley of Ten Thousand Smokes in Alaska, which has been aside as a national monument. This group of fumaroles was brought into existence by the eruption of Mount Katmai in 1912. This valley, with an area of about 50 square miles, contains thousands of vents from which steam and gases escape. The temperatura of the gases vary from that of ordinary steam to superheated steam so hot that it comes forth as a dry gas.

Also associated with volcanic activity of current or recent date are hot *springs*. Surface waters which penetrate the ground may be heated either by contact with rocks not yet cooled or by gaseous emanations from the volcanic rocks and, re-emerging at the surface, give rise to hot springs. Under special conditions the hot springs may be intermittently eruptive. These intermittently eruptive hot springs are called *geysers*. One of the best-known geyser and hot spring areas in the world is Yellowstone National Park in Wyoming. Within this area of about 50 square miles, there are about 100 geysers and 3000 ordinary hot sorings.

Words and phreses

not only also = nu numai ..., dar şi
taken as a whole = luată ca un tot, luată în general
it follows that whenever = rezultă că ori de câte ori
of the kinds of matter = a celor două feluri de materie

er at least tends to do so = sau cel puţin tinde s-o facă
in so far as any portion = în măsură în care fiecare porţiune
the same laws hold good(true) = aceleaşi legi sunt valabile
the relation does not hold true = relaţia nu este valabilă, adevărată
merge into each other = se îmbină una cu alta
deep-lying compact zone = zona compactă de la adâncime
may better be considered later = este mai bine să le discutăm mai târziu, pot fi discutate mai bine ulterior.

EXERCISES

I. *Abswer the following questions:*

– How is used the term volcanism?
– Which is the explanation of the ascensive action?
– What happens when there are stress-differences?
– What happens to any position of the interior when it becomes liquid?
– Which are the two phases assumed by the foreign of fluid rock outward?
– What do they constitute?
– Which is the difference between irruptions and eruption?

II. *Give antonyms for the following adjectives:* heavy, difficult, hard, free, less.

Build up sentences with each pair of adjectives.

III. *Find English equivalents for the fallowine Romanian phrases maing paying attention to the verb „to take'.*

a face o călătorie; a face o baie; a scoate haina; a scoate pălăria; a avea loc; a semăna cu.

IV. *Find nouns in the text corresponding to the following words:* to act, to move, rocky, philosopher, to matter, resulting in, to tend, to stress, slowly, diffused, earthly, to erupt.

V. *Name the Romanian vulcanic mountains and the regions in eur country where the phenomena associated with vulcanism are to be found.*

VI. *Translato into Romanian:*

When molten rock is formed to the surface it gives rise to the most intense and impressive of all geological phenomena. The energies acquired in the interior under great compression here find sudden relief. In the types of eruption prevailing at the present time, the levas are forced out through ducts or perhaps short fissures or sections of fissures.

VII. *Translate into English:*

Vulcanii complecşi sau compuşi constau din asocierea a două sau mai multe tipuri de mai sus. De pildă, un vulcan asociat cu un dom vulcanic este un vulcan complex. După gruparea lor, vulcanii se clasifică în două: un complex (ciochine) vulcanic, ce constă dintr-o grupare de vulcani fără un aranjament sistematic şi un lanţ vulcanic, ce constă din vulcanii aliniaţi, fosarte probabil centrele vulcanice fiind eşalonate pe o linie de fractură de adâncime;de pildă, lanţul vulcanic (de la vest de Carpaţii Orientali) Harghita, Căliman, Tibleş, Gutâi, Oaş, vestul Slkovaciei, lung de peste 800 km. Acest lanţ vulcanic, cel mai grandios efect vulcanic din Europa, după clasificarea lui Stille, intră în categoria magmatismului subsecvent, dar de natură extrusivă, adică de un magmatism posttectonic, ce a început să se formeze din tortonian când fazele de cutare principale din Carpaţi se efectuaseră deja.

LESSON IV

E A R T H Q U A K E S

A type of earth movement that locally gives rise to engineering problems is the earthquake. Earthquakes are vibrations or tremors of the aerth. A great mony small quakes are vibrations artifficially induced by heavy street traffic, by railway trains or by similar disturbances. Explosions also cause artifficial earthquakes. In general,

man–made aerthquakes are felt over very limited areas. In contrast, natural earthquakes which result from a sudden release of energy within the earth may be felt over wide areas, Some of the greater shocks have been perceptible over areas of more than a million and a half square miles. Other natural quakes, to be sure, have been localized within areas of a few square miles.

Classification

Although natural quakes have a variety of minor causes, two principal genetic classes ars recognized: vulcanic earthquakes and tectonic earthquakes.

Volcanic Earthquakes. Shocks which result from explosions incident to the eruption of a volcanic or from violent subterranean movements of lava are termed *volcanic earthquakes.* These may be violent and locally destructive but are commonly felt over very limited areas. An example of this type of quake is the Fordo Machia (Sicily) quake of 1911 which destroyed the buildings within an are three miles long and a quarter mile wide, but was not felt six miles away.

Tectonic Earthquakes. Tectonic earthquakes are those due to sudden dislocations of large blocks of rock. When rocks are stressed beyond their elastic limit sudden relief by breaking, or fgaultingm, allows the rock masses on either side of the break to rebound elastically to positions wholly or partially relieving the strain. Tectonic quakes constitute most of those felt over great areas.

Earthquakes vibrations are set up or start from a limited area and are propagated outward in all directions. This central area of initiation beneath the earthis surface is called the *focus* or *focal area.* The ground surface directly above it, where shaking is most intense, is called the *epicenter* or *epicentral area.* The foci of the majority of earthquakes are at depths of less than 10 miles. Many quakes originate at depths between 10 and 30 miles, however, amd recent work as shown that some quakes originate at greater depths; the centers of a few have been estimated at more than 400 miles below the surface.

Earthquake vibration are recorded by instruments called *seismometers*, of which numerous models are in currant use. Most of the modern instruments have a high degree of precision and great sensitivity. The vibrations detected by seismomaters are commonly recorded on photographic paper as a series of zig–zag lines. These records, called seismograms, show the vibratory impulses and the time of initiation and duration; they also depict the arrival of the different wave types. Earth shocks are commonly of short duration. They last from a few seconds to somewhat over a minute. The great San Francisco earthquake of 1906 lasted between 40 and 50 seconds. The duration of a shock is very important because the destructive effects increase greatly with increase in lenght of dutarion. After an earthquake has taken place, secondary or aftershocks, commonly of lesser intensity, may follow intermittently for saveral months.

Words and phrases

a great many = multe, o mulţime de
artifficially induced = produse în mod artificial
man–made earthquakes = cutremure provocate de către om
sudden release = degajare bruscă
to be sure = a fi sigur; (aici) cu siguranţă că
but are commonly felt = dar sunt în mod obişnuit (integral) simţite
within an area = pe o suprafaţă de
on either side of = de fiecare parte a
somewhat over a minute = cu ceva peste un minut; (aici) las un minut şi ceva.

EXERCISES

I. *Answer the following questions:*

– What are earthquakes?
– What are the causes of the artificially vibrations?
– What may cause a natural earthquake?
– What is a volcanic earthuake?

– How is the tectonic earthquake produced?
– Which of them is felt over greater areas?
– What is a seismometer and what doss it recoıd?

II. *Turn the following distances into the metric system,* knowing that one mile is as much as 1.609 m. – a foot is 30.48 cm. – a yard is 91.44 cm, and an inch i9s 2.54 cm.

10 miles, 27,5 miles, 6 yards, 12 1/4 yards, 6 feet, 4 inches, 8 feet and eight inches, 10 feet and two inches.

III. *How much is 1 ha,* 50m², 46 m³, 8 dcm, 80 mm, using the English system of measure.

IV. *Give the principal forms of the following verbs:*

to risc, to raise, to feel, to build, to break, to allow, to lie, to lay.

V. *Find English equivalents for the Romanian phrases:*

a pune accentul pe (cuvânt, silabă), părţile maşinii sub tensiune, rocele sunt presate, ceea ce este subliniat, regiuni cu o mare presiune.

VI. *Fill in the blanks with many, much and their equivalents.*

How...examinations have you on this term?

When I began reading English in original I had to look up ... words ... of our students attended the meeting.

I cannot buy the car. It costs too ...

How ... is to read?

How ... students are you in the first year?

He knows ... about it.

I spent ... of time on the problem.

VII. *Translate into Romanian:*

Since the beginning of the twentieth century seismologic data have been reapidly accumulating and have been brought together into accessible form throught the cooperative efforts of seismologists. Maps showing the locations of the earthquake epicenters bring out strikingly two major belts in which the majority of recent earthquakes have originated.

VIII. *Translate into English:*

Au fost cuprinse sub numele de cutremure de pământ mişcările de scurtă durată care determină zguduiri bruşte în scoarţa terestră. Ele se mai numesc şi mişcări seismice după cuvântul de origine greacă „seismos" care înseamnă zguduire; de aici termenul de Seismologie utilizat pentru ştiinţa care se ocupă cu studiul cutremurelelor de pământ. V. A. Obrucev arată că din datele statistice obţinute prin înregistrarea acestor mişcări rezultă că într-un an se produc circa 8000–10000 de cutremure, cu alte cuvinte are loc aproximativ un cutremur la o oră şi un sfert. În realitate numărul lor trebuie să fie cu mult mai mare, deoarece 2/3 din suprafaţa globului terestru sunt acoperite de apă unde nu există staţiuni care să înregistreze cutremurele. La acest considerent se mai poate adăuga faptul că şi pe uscat sunt suprafeţe mari care încă nu au staţii seismologice. Din aceste constatări ar reieşi că numărul cutremurelor este foarte mare dar majoritatea sunt de o slabă intensitate şi nu sunt simţite de om ci numai de aparatele de înregistrare.

LESSON V
SHORELINES

The tens of housands of miles of shorelines, hoth sea and lake, give rise to a variety of engineering problems. At places are found sandy beaches; some are stabl, but many are undergoing rapid alteration. Elsewhere are found rocky shores but even these locally give way before the onslaught of waves. Engineering structures to prevent losses by erosion, to control deposition to stabilize or improve existing conditions, to maintain or to create shore harbor facilities call for engineering skill and ingenuity based on knowledge of the underlying geological principles.

The Margins of the Seas

Nearly three– quarters of the earth's surface is covered by the seas. Although formarly thought to be monotonous plains, the topographie diversity of the sea floors has been demonstrated by recent soundings to be fully comparable with that of the continents. Deeps extend downward more than 6 miles bencath the ses surface; mountain chains rise above the floors of the seas, and some of them emerge above the surface to form island arcs; volcanoes rise above the sea floor, and may of them rise high above the sea level.

Sea Water Movements

Several different types of water movement produce erosion and deposition along shores and coastlines. Waves, undertow, alonghore currents, tides and tidal currents interact to bring about the observed results. Or these agentsm by far the most importasnt are waves and alongshore currents.

Waves. Everly exposed body of standing water is disturbed to a greater or lesser extent by waves. The size and energy of waves are conditioned by the surface area oof the water, by the depths of water, and by the disturbance which creates the waves. Some shores are little affected by wave work because of shoal waters which margin them; others are little affected because of protected positions or short fetch of water facing storm directions; and others, because of resistant rock make–up, yield but slowly. A consideration of wave action necessarily distinguishes between wave types. The two major classes of waves acting on shores and coasts are oscillatory waves and translatory waves.

Currents. Waves are not the only water that modify shore zones. The variety of currents that stir the waters of the seas is surprising. Density currents, salinity currents, river currents, tidal currents, wave currents, undertow, conventional currents, and perhaps other affect greater or lesser volumes of water, and to some extend, at least locally, modify in one wayer or another the adjacent lands.

Words and phrases

the tens of thousands of miles = zecile de mi de mile
give rise to = dau naştere la
at place = (aici) în unele locuri
undergoing rapid alterations = suferind schimbări rapide
elsewhere are found = (aici) în alte părţi sunt (se află)
harbour facilities = condiţii favorabile de adăpostire
call for = reclamă, necesită
although formerly thought = deşi la început socotite
the floor of the sea = fundul mării
by far the most important are = (aici) cu adevărat cele mai importante sunt
by far = cu mult
wave work = acţiunea valului
shoal water = apă puţin adâncă
and to some extent = şi într-o oarecare ,măsură
in one way and another = într-un fel sau altul.

EXERCISES

I. *Answer the following questions:*

– What are shorelines?

What material are thay made of?

– How do you call the margius of oceans, seas, rivers, lakes?

– What may be seen on the sen and ocean floors?

– Which are the chief water movememnts (and among them the most important ores)?

– How do the waves and currents act upon the shores?

II. *Fill in the blasnks with suitable words from the text:*

Some shores are little affected by ... because of shoal... which margin them; others are little ... because of protected ... or short fetch of water facing ... directions; and others, because of ... rock made–up, yield but slowly. A consideration of wave ... necessarily

... between wave types. The two major ... of waves acting on ... and coasts are ... waves and ... waves.

III. *Form nouns from the following adjectives:*

rocky, monotonous, important, sandy, stormy, necessary, local, distinctive, variant, varied.

IV. *Name all the continents and oceans*

V. *Translate into Romanian:*

Antarctica whose areas of 14 million square kilometers makes it larger than the whole Europe, lies at and arounds the South Pole. With its islands and the sectors of the Pacific, Indian and Atlantic oceans which wash its coasts, it constitutes the West South polar region known as the Antarctic. The land is montainous and with exception of exceedingly steep mountain peaks, is almost entirely coveredd with eternal snow and ice. Huge glaciers creep slowly from the continent into the waters of the three seas, sending gigantic iceberg into the seas. The continents is rich in valuable mineral resources. The mountains of Antarctica coutain over 140 different minerals including gold, silver, copper, lead, iron and uranium. Summer in the Antarctic lasts for little over a month from the end of December to February. But it does not bring warm weather, the temperatures seldom rising above 0° centigrade. However, some places along the coast which free from ice are warmed up by the sun. Here can be found small natches of tundra inhabited by wingless insects and visited by penguins and petrels.

VI. *Answer the following question:*

– What is Antarctica?
– In ehat hemisphere does Antarctica lie?
– What do we call the regions eround the North and South Poles?
– What minerals are found in Antarctica?
– How long does Summer last there?
– What are the fauna and flora like in Antarctica?

VII. *Translate into English:*

Bazinele oceanice. S-au cuprins sub numele de bazine oceanice întinderile cele mai mari de apă grupate în patru bazine. Dintre acestea Oceanul Pacific este cel mai mare şi are o suprafaţă de 179,7 milioane km2. Urmează în ordine Oceranul Atlantic cu o suprafaţă mai mică evaluată la 93,4 milioane km² şi apoi Oceanul Indian, cu o suprafaţă de 74,9 milioane km². Aceste oceane se unesc în regiunea antarctică şi despart patru mari blocuri continentale: Eurasia, America de Nord şi Sud, Australia şi Antarctica. În jurul polului nord se deosebeşte un al patrulea mare bazin, numit Oceanul Îngheţat sau Arctic care ocupă o syuprafaţă de 13,1 km². Bazinele marine sunt acumulări mari de apă care mărginesc bazinele oceanice sau care pătrund adânc în interiorul uscatuiui. Unele dintre mări sunt în strânsă legătură cu bazinele oceanice, altele abia mai comunică prin strâmtori, iar altele au rupt legătura completă cu oceanele.

LESSON VI

GEOLOGIC WORK OF WIND

Wind is simply air with a horizontal component of motion. The velocity of wind currents varies from nothing in an absolute calm to as much as 272 miles per hour, the maximum recorded velocity. The vertical velocity gradient is generally steep. The lowest wind velocities are close to the ground because of the retarding effect of surface irregularities, brush, trees, and other obstructions. Because the lowest velocities are close to the ground, the wind is at a disadvantage in acquiring a sediment load. Tending to offset this, however, is the irregularity of currents near the ground, which increases the erosive effectiviness of the wind.

Wind Erosion. Unless armed with solid particles wind erosion is minor. Where charged with solid particles however, natural sand blast are highly abrasive. Thus, for a spherical grain of quartz,

0 03 mm, in diameter, suddenly projected into an air stream of 33 miles per hour velocity, the force of air on it is five hundred times the weight of the sphere. Small partiucles therefore traval essentially with the wind and are deflected with the air stream about an obsctruction. Collisions are less frequent than with the transport of large particle, and abrasive effects both on the particles and on obstruction is lass. The erosional effect of wind consequently is concentrated at the base of an obstruction rising above the general surface of the ground.

Wind Deposits. Deposition of wind-borne sediment takes place where the velocity of a wind current drops below that required to maintain movement of the solid loads or where precipitation washes the air. Wind-transported dust is universally distributed. Indeed, it has often been said that every square mile of the earth's surface contains wind-blown particles derived from every square mile of the lands. Mechanical transport by winis, as by streams, consists of tractional dragging or rolling of particles along the surface, suspension, and saltation. The coarse particles, sand size, which move along at or near the surface, locally accumulate into drifts called dunes; the fine particles, chiefly of silt size, which are carried in suspension form blanket-like deposits of loess. Dunes are found near sources of sand available to wind transport. Behind many shores, either marine or lake, elongate dune ridges or narrow, elongate zones of irregular dunes parallel the shore. Along the sandy flood plains of some streams, dunes are found, especially on the leeward side of the valley with respect to prevailing winds. Sandy deserts also display a variety of dunes. A deposit of wind-blown dust and silt which typically shows no stratification is known as loess.

Words and phrases

to as much as = până la
are close to the ground = chiar la suprafaţa pământului
the wind is at a disadvantage = vântul este lipsit de
tending to offset this = având tendinţa să diminueze aceasta

unless armed = dacă nu este însoțit
suddenly projected = proiectat spontan
sandy flood plains = câmpii inundate de nisip
with respect to prevailing winds = cu privire la vânturile predominante

EXERCISES

I. *Answer the following questions:*
- What is wind?
- Which are the limits of the wind velocity?
- Where are the lowest wind velocities and why?
- What is the geologic work of wind?
- Where are deflected the particles which travel with the wind?
- What is the eresional effect of wind?
- How does the wind act to form wind-deposits?
- What are dunes and loesses?

II. *Give synonyms for the following words:*
calm, to transport, mode, rapid, differend, chief, ground, broad.

III. *Give derivatives of the following verbs and translate them into Romanian:*
to compose, to react, to develop, to form, to deposit, to occur, to act.

IV. *By shifting the stress some nouns have become verbs and viceversa. Stress the following pairs of nouns and verbs:*

abstract	to abstract	permit	to permit
compound	to compound	produce	to produce
contest	to contest	record	to record
decrease	to decrease	subject	to subject
increase	to increase	transport	to transport
upset	to upset		

V. *Fill in the blanks with prepositions, then read and translate into Romanian:*

The structure...rock has much to do...the rate...its erosion. Other things equal, stratified rock is nore readily eroded than massive rock, since stratification plains are plains...cleavage, and therefore...weakness. Taking advantage...these plains, the water has less breaking...perform...reduce the material...a transportable condition.

VI. *Add negative affixes to the following words and translate them into Romanian:*

to connect, possible, common, usual, motion, mobile, distinct.

VII. *Translate into Romanian:*

The earth is continually changing. Some changes are great and rapid while others are small and slow although they are nevertheless effective. The geologist seeks to analyse the changes and the processes that causes them. He assumes that these processes have been operative during the past as well as the present, and he seeks to explain the present earth as the result of processes which have been active through long ages of time. Thus the present is the key to the history of the present.

VIII. *Translate into English:*

Atmosfea în mişcare este un agent activ care exercită asupra scoarţei Pământului o acţiune tot aşa de însemnată ca şi în stare statică. Procesul pe care îl suferă suprafaţa uscatului sub acţiunea aerului în mişcare este cunoscut sub numele de acţiunea mecanică a atmosferei. Intensitatea fenomenului depinde de viteza de deplasare a aerului. Aerul în mişcare poartă numele de vânt. Viteza lui se măsoară în metri pe secundă şi a fost stabilită de Beaufort care a dat şi o scară a intensităţii numită scara lui Beaufort. La stabilirea acestei scări s-a avut în vedere efectele imediat perceptibile ale aerului în mişcare. În regiunile de pustiuri, acolo unde suprafaţa scoarţei terestre este lipsită de vegetaţie, vântul reprezintă forţa dinamică cea mai puternică. În acţiunea mecanică a atmosferei se pot deosebi trei procese: 1. deflaţia şi transportul; 2. coraziunea (roadere) şi 3. sedimentarea.

LESSON VII

THE CONSOLIDATED SEDIMENTS

Although, technically, the unconsolidated sediments are rock, to most people, the term *rock* connotes some degree of coherence or consolidation. Some sediments are consolidated soon after deposition; other deposits may exist for millions of years in the unconsolidated state, and there are all gradations and degrees of consolidation. The aggregate changes occuring between deposition and consolidation are termed diagenesis.

Consolidation

During diagenesis, coherence is developed by compaction and dehydration, cementation, and recrystallization. Although one of these consolidating processes may be dominant locally, commonly the three are concurrently at work.

Compaction and Dehydration. With burial under additional deposits, settling under load takes place with the expulsion of excess water. Ultimately, cohesive bonds are established or strengthened, and the sediment gains an appreciable degree of solidity. This type of consolidation operates most effectively on the finer-grained sediments of the clay group, upon mixtures of grade sizes containing a clay fraction, or upon other sedimentary types with a colloidal content. The transformation of clay to shale or that of peat to coal are familiar examples.

Cementation. In deposits through which water can circulate, dissolved mineral matter may be precipitated, sticking the grains or fragments together, and reducing the void space. The mineral cements may be introduced into the mass from outside by circulating water or may be derived from within the mass by solution or alteration of some of its constituent parts. Three common mineral cements are: silica (quartz), calcium carbonate (calcite), and iron oxides in various degrees of hydration. In the discussion of chemical

weathering it was shown that these three substances – silica, calcium carbonate and iron oxides – are abundantly produced by the alteration of most types of rocks. Silica makes the strongest and most durable of the mineral cements, with iron oxide and calcite somewhat less effective.

Recrystallization. The components of a sediment may crystallize or recrystallize, giving coherence to the rock. Water is expelled, void space reduced, and the bonds between the new crystals established. These processes are assisted by the development of an interlocking fabric or grain. Lime Deposits recrystallize rather readily, and many limestones that have suffered no squeezing other than that of superincumbent load have recrystallized completely. Recrystallization is probably initiated very early in the history of clays, also, with the development of finely divided white mica. In the formation of clay minerals by weathering, the potash liberated seems to have an affinity for the clay and tends to remain associated with it. During recrystallization, chemical recombination of the potassium, silica, alumina, and some water forms the white mica, sericite. It has been shown that colloidal or soluble silica is liberated in the alteration of silicate minerals. In so far as this is deposited with the clays and subsequently crystallized into quartz, it serves as a binding agent.

Words and phrases

connotes some degree = înseamnă un oarecare grad
commonly the three are concurrently at work = în mod obişnuit toate trei acţionează simultan
with burial under additional deposits = prin îngropare sub depozite mai noi
settling under load = tasare sub greutate
ultimately = în sfârşit, la urmă, în fine
the void space = spaţiul gol (liber)
chemical weathering = dezagregare chimică
are assisted by = sunt însoţite de
in so far as = în măsura în care

EXERCISES

I. *Answer the following questions:*

– What is meant by the term rock?
– What are rocks composed of?
– What is the essential feature of stratified rock?
– What is cementation?
– What are crystallization and recrystallization?

II. *Give derivatives of the following words and translate then into Romanian:*

strong, sand, to arrange, long, wide, sediment, deep.

III. *Fill in the definite or indefinite article where required*

By...term „rock", geologically speaking, is meant...material composing one of...individual parts of...earth's solid crust. The term is also used with different meanings; it may be denotive of...substances forming part of...earth's crust, for example, quarts and feldspar arranged in...particular manner are said to form...rock-granite or it may refer to...masses themselves and thus passes...larger, geologic significance.Rocks are sometimes defined as aggregates of one or more minerals, but this is not...broad enough or wholly definition.

IV. *Ask questions to which the following answers may be given; Translate the answers into Romanian:*

– Rocks may be composed entirely of minerals or entirely of glass or of a mixture of both.

– Minerals are substances having definite chemical composition and usually of crystalline structure.

– Glasses are molten masses chilled and solidified without definite composition and structure.

– Rocks composed wholly of minerals may be simple or compound according to their mode of origin, the position of the masses with respect to the earth's crust and to each other, rocks naturally divide themselves intonthree groups.

– Ignous rocks are solidified molten masses; sedimentary rocks are precipitated sediments and metamorphic rocks are formed from 1 and 2.

V. *Form sentences using the verbs in column I and phraseological combinations in column II*

I	II
to find	to find out
to place	out of place
to call	to call for
to rise	to rise against
to speak	to speak upon
to bring	to bring forward

VI. *Translate into Romanian:*

The sediment carried away by the transporting agents is sooner or later deposited again. Sand blown by the wind collects into sand dunes in the desert or bordering the seashore. Where glaciers melt away, the debris gathered up during their journey is dumped down unsorted, to be dealt with later by rivers or the sea. When a stream enters a lake the current is checked and the load of sand and mud gradually settles to the bottom.

Out of the sea floor the finer particles are deposited as broad fringes of sediment, the finest material of all being swent far across the continental shelves, and even over the edge towards the deeper ocean floor, before it finally comes to rest. All these deposits are examples of sedimentary rocks in the making.

VII. *Translate into English:*

În structura orizontală concordantă rocile sunt paralele şi în continuitate de sedimentare şi aproape orizontale. Suprafeţe perfecte orizontale nu se găsesc, deoarece stratele capătă o înclinare chiar şi în procesul formării lor. Alt fapt care contribuie ca stratele orizontale

să aibă un caracter limitat în formaţiile vechi este acela că acestea se deformează ulterior formării lor. Aceasta face ca strate orizontale să nu se găsească decât la rocile tinere, iar la roci vechi, decât pe platformele vechi, cum ar fi Platforma rusă, siberiană etc.

În timpul sedimentării, stratele iau o poziţie ce depinde de alura suprafeţei de depunere. De pildă, la conurile de dejecţie se observă o stratificaţie aproximativ paralelă cu suprafaţa conului, deci, înclinată. Nisipul la dune este depus pe feţele mai înclinate şi deci şi acesta are o poziţie înclinată.

Table 7.1. **A Classification of Sedimentary Rocks**

Nature of Sediments		Sedimentary Rocks	
Angular particles more than 2 mm in greatest dimension	Rubble composed of sharp-stones	SHARP-STONES	CONFLO-MERATE
Rounded particles more than 2 mm in greatest dimension	Gravel composed of round-stones	ROUND-STONE	
Dominantly Fragmental Angular and rounded particles of rocks and minerals ranging in greatest dimension from 2 mm to 0.1 mm	Volcanic fragments = Tuff Mixture of rock and mineral fragments Quartz = Feldspar Quartz + other minerals in large amount Quartz + other minerals in large amount	Tuffstone Graywacke Arkose	SAND-STONE
Rock and mineral particles ranging in greatest dimension from 0.1 mm to 0.001 mm and colloidal particles less than 0.001 mm in greatest dimension	Volcanic Ash Silt particles 0–0.01 mm Clay minerals less than 0.01 mm Silt + Clay + Water = Mud	Ashstone Siltstone Claystone Mudstone	SHALE

Table 7.1. **A Classification of Sedimentary Rocks** (Followed)

Nature of Sediments		Sedimentary Rocks	
II III Fe and Fe compounds precipitated inorganically and organically as concretions, nodules and layers. Impurities commonly present in the layers.	Iron concretions Iron compounds + mud, silica etc.	Concretionary Precipitated	IRON-STONE
Partly Fragmental		Partly Precipitated	
Siliceous inorganic fragments less + han 2 mm in greatest dimension	Inorganic fragments	Fragmental	
Siliceous organic hard parts and their fragments	Diatom frustules, radiolarian skeletons and sponge spicules		Silicastone
Partly Fragmental		Partly Precipitated	
Silica precipitated as colites, pisolites etc.	Siliceous concretions	Concretionary	
Silica precipitated from suspension and solutions	Chert, flint, sinter etc.	Precipitated	
Plant structures – spores, fronds, leaves, wood etc. Inorganic sediment Waxes, resins etc. from decomposition of plants	Plant debris; inorganic impurities Plant fluids		COAL
Dalcite and Aragonite fragments Calcarous organic hard parts – shells, exoskeletons, plates, spines and fragments		Fragmental	
Organically and inorganically precipitated concretions Inorganically precipitated $CaCO_3$ – Evaporation etc. Organically precipitated $CaCO_3$–(1) by NH_3 from decomposition; (2) loss of CO_2 to plants etc.		Concretionary Precipitated Recrystallized	LIME-STONE

Table 7.1. **A Classification of Sedimentary Rocks (Followed)**

Nature of Sediments			Sedimentary Rocks	
Dolomite fragments Dolomitized organic hard parts			Fragmental	
Dolomitic concretions			Concretionary	DOLOSTONE
Organically precipitated dolomite Inorganically precipitated dolomite			Precipitated	
Fragments of anhydrite, gypsum, halite, alkali, nitrate caliche etc.			Fragmental	
Possibly Fragmental			Dominantly precipitated	
Evaporites – mineral precipitated during evaporation of saline waters	Anhydrite Gypsum		Anhydrock Gyprock	
	Chlorides Nitrates Other rare salt	Precipitated		SALINASTONE

La delte am văzut că depozitele frontale sunt înclinate. Pe plajă se vede că stratele înclină spre largul mării paralel cu suprafaţa plajei. Unghiul vertical al unui depozit depus înclinat faţă de orizontală se numeşte înclinare primară sau originală a stratelor.

LESSON VIII

IGNEOUS ROCKS

Of the three major rokc groups, the igneous rocks constitute the major portion of the solid part of the earth, at least in the outer zons. From this group, as has already been indicated, are derived the metamorphic and sedimentary rocks.

Igneous activity can be subdivided into two main classes: (1) subsurface movements, or intrusive activity; (2) surface movements, or extrusive activity. It is obvious, of course, that the molten lavas which issue at the earth's surface through rents or openings had their origin beneath the surface and have moved radially outward.

There is thus a gradation or connection between intrusive and extrusive action. The significance of the terms *intrusion* and *extrusion* as applied to molten rock masses is made readily apparent by a simple analogy. A toothpaste tube can be squeezed causing *extrusion* of the peste. If, however, the mounth of the tube is inserted into a dish of gelatine and then squeezed, the paste is *intruded* into the gelatine, making room for itself by crowding the gelatine aside. Some geologists have classified igneous rocks into the following three groups: deep–seated, or plutonic; intermediate, or *hypabyssal;* and shallow or *extrusive.*

The intrusive igneous rocks, as stated, are those that have solidified from molten rock solutions called magmas which have penetrated other rocks. These intrusion vary in size from very minute occurance to masses hundreds of miles in extent. They may penetrate sedimentary, metamorphic or other igneous rocks.

Intrusive Rock Types. The intrusive rocks may be divided into a number of types, exemples of which are granite, syenite, or diorite.

As the temperature of the magma, or molton rock solution, drops, crystallization is initiated. The order of crystallization is the order in which mineral components become insoluble in the rock solution. Careful studies of good many igneous rock have established the very commonn order of crystallization of the common rock-making minerals.

The size and arrangement of the crystals composing the igneous rock define the property known as *texture.* Certain of the rocks which hardened without crystallizing are said to have a glassy texture. Crystallized igneous rocks show a variety of grain sizes and arrangements. These gradations may be expressed in terms of the size of grain as follows:

Very coarse	more than 3 cm
Coarse	more than 5 mm
Medium	1 to 5 mm
Fine	Less than 1 mm
Dense	Individual minerals too small to be distinguished without magnification.

Two other textural varieties should be mentioned. The first of these is pegmatitic texture, which is a coarse, very irregular type crystallization. In rocks displaying the pegmatic type of texture, individual constituents may vary in size from a small fraction of an inch to several feet. Exceptionally, mineral crystals occur with a minimum dimension of 20 feet or more. The chief characteristic is irreegularity. Porphyritic texture should also be defined. This texture consists of relatively large crystals included in a groundmass or matrix or relatively finer texture. However, it be understood that the groundmass of the crystalline rocks may be very coarse , medium, fine, dense, or uncrystallized with glassy texture.

Words and phrases

at least in the puter zone = cel puţin în zona exterioară
it is obvious = este evident
is made reaidly apparent = se face uşor observată (se observă cu uşurinţă)
making room for itself = făcându-şi loc
very minute occurences = apariţii minuscule
as the temperature drops = pe măsură ce temperatura scade
of a good many = multe, o mulţime de.

EXERCISES

I. *Answer the following questions:*
- What substances are regarded as minerals?
- What main groups of rocks do you know?
- What rocks may be defined as hardened lavas?
- What does the texture of sedimentary rocks depend upon?
- How does the size of grain vary?
- What is the difference between sedimentary and igneous rocks?

II. *Find synonyms among the following words:*

earth, to define, to record, common, old, petroleum, ground, to designate, to register, ordinary, ancient, oil, substance, soil, usual, antique, material, naphta, land, matter.

III. *Form sentences using the verbs in column I and phraseological combinations in column II. Translate3 the sentences into Romanian.*

I	II
to get	to get off
to run	to run into
to make	to make one's way
to look	to look through
to move	to move aside
to make	to make room

IV. *Ask questions to which the following answers may be given:*

– Mantle rock is absent in some places and there the surface of the solid rock appears.

– If the mantle rock were stripped from the land, the solid part bensath would be found to be made up many kinds of rocks.

– The layers may be distinct or indistinct, and thick ot thin.

– Where deposit waters are agitated vigorously to the bottom, coarese sediment is deposited.

– Where waters are quiet at the bottonm, the sediment is fine.

V. *Give the antonyms of the following words:*

great, good, new, badly, much, many, to shut, to go up to.

VI. *Fill in the blanks with prepositions:*

The intrusive rocks may be divided ... a number... types, examples ... which are granite, syemite, or diorite. The order, ..., crystallization is the order ... which mineral components insoluble ... the rock solution. Careful studies ... a good many igneous rocks have established the very common order ... crystallization ... the common rock–making minerals.

... rocks displaying the pegmatic type ... texture, individual constituents may vary ... size ... a small fraction ... an inch ... several feet.

VII. *Translate into Romanian:*

Most of the rocks formed by processes of internal origin (endogenetic) belong to the metamorphic or igneous groups. But it must never be forgotten that there are, inevitably, many rocks that are transitional between these groups. Loose sediments are progressively changed into firm, indurated sedimentary rocks by consolidation and concentration. These changes are described as lithification or diagenesis, and it is not always clear just where diagenesis ends and metamorphism begins. However, in practic this leads to no serious difficulties.

VIII. *Translate into English:*

Rocile eruptive extrusive se formează din consolidarea lavei ce curge liniştit la suprafaţa pământului sub formă de curgeri, sau din consolidarea lavei aruncate în aer, sub formă de sfărâmături şi depunerea ei ulterioară, la suprafaţa pământului, sub formă de strate piroclastice,. Studiulrocilor eruptive face obiectul mai multor discipline, în special al petrologiei. Deoarece masele vulcanice contribuie la arhitectura scoarţei, studiul lor intră şi în obiectul disciplinei noastre. Pentru a putea avea un fond adecvat de discuţie, trebuie să întrebuinţăm şi o serie de noţiuni nestructurale. Mai întâi, trebuie să arătăm că în manualele de geologie termenii de structură şi textură nu sunt la fel definiţi. După unii autori, structura este modul de aranjare în spaţiu a mineralelor, iar textura se referă la raportul dintre mărimea granulelor. După alţi autori, aceste noţiuni se înţeleg invers, adică textura este orientarea în spaţiu a mineralelor, iar structura, raportul de mărime.

LESSON IX

METAMORPHISM AND THE METAMORPHIC ROCKS

Metamorphism is a general or broad term which includes all rock alteration. Commonly, however, a more restricted usage is followed, whereby metamorphism includes only processes which remarke the rock into one of equal or greater coherence and crystallinity. The

agents that produce metamorphism are heat, stress, and solution. The dominant process is recrystallization.

Processes of Metamorphism

Four processes may be distinguished in an analysis of metamorphism: granulation, plastic deformation, recrystallization and metasomatism. Although for convenience these are considered separately, in nature the processes overlap and fraquently have been concurrently effective in the production of metamorphic rocks.

Types of Metamorphism

Two general types of metamorphism are distinguishable: contact metamorphism and dynamic metamorphism. The first, *contact metamorphism* occurs in association with igneous invasions, and the second, *dynamic metamorphism,* occurs in association with major earth movements and deformation. Over wide areas where intrusion and mountain–making have been effective, metamorphism may by general; hence the expression *regional metamorphism* is frequently used by many geologists.

Metamorphisc processes are gradational. A hard brittle mineral may be crushed while adjacent minerals are recrystallized. The softer argillaceous beds of a sedimentary sequence may be changed to slate or schist while comparatively little change is taking plabe in more resistant neighbouring beds. Contact alterations are frequently accompanied by dynamic metamorphism and vice versa. The products of metamorphism are likewise gradational. Quartzites, for example, grade into quartz–mica schists, with an increase in mica: or, if banded, they grade into quatzite gneisses. Similar gradations of carbonate rocks, from marble to schist ot to lime–silicate gneiss, are common.

The metamorphic processes are constructional in nature. The elements are recombined into minerals stable under high temperatures, high pressures, conditions of plastic flow, or a combination on these. In addition there may be introduction or elimination of

certain elements or boht. It may be noted that the processes are a reversal of those of weathering. The end – products of extreme metamorphism may be truly igneous rocks.

Words and phrases

commonly, however, a more restricted usage is followed = cu toate acestea, în mod obişnuit, are un înţeles mai restrâns
stress = presiune
a hard brittle mineral = un mineral dur
and frerquently have been concurrently effective = şi adesea au participat concomitent
of a sedimentary sequence = de natură sedimentară
the end products = produse finite.

EXERCISES

I. *Answer the following questions:*
- What are metamorphic rocks?
- What are the rocks composed of?
- Which are the four processes of metamorphism?
- Which are the agents that produce metamorphism?
- What are the types of metamorphism?
- What may be the end–products of extreme metamorphism?

II. *Find entonyme among the following words:*
recent, old, usual, rapid, new, unusual, ancient, slow, frequently, common, often, seldon, uncommon, rarely.

III. *Look up the meanings of the following words:*
even, perfect, direct, matter, as, for, like.

IV. *Give derivatives of the following words and comment on their formation:*
to consider, to operate, to divide, to accomplish, to direct, geology, deposit, to precipitate, to move, to differ.

V. *Fill in the blanks with suitable words from the text:*

Metamorphic .. are graditional. A hard brittle ... may be considered while ... minerals are recrystallized. The softer ... beds of a sedimentary sequence may be ... to slate or schist while comparatively little change is ... in more resistant neighboring beds. Contact alterations are ... accompanied br dynamic ... and vice versa. The ... of metamophism are likewise graditional.

VI. *Translate into Romanian:*

Recrystallization is the regoupinf of the elements into new crystals. Atomic rearrangements may form either new mineralsor new crystals of minerals formely present. Just how this rearrangement takes place is not fully understood, although recent work has shed much light on the matter. Plastic deformation and granulation have been described as processes of metamorphism. During granulation heat is produced which locally may be even sufficient to partially melt the rock.

VII. *Translate into English:*

Geologia dinamică sau Geodinamica se ocupă cu studiul tuturor proceselor geologice care au loc în litosferă sau la suprafaţa ei sub acţiunea cauzală a agenţilor interni şi externi. Ea studiază raporturile dintre cauză şi efect ca o înlănţuire de fenomene care se condiţionează reciproc într-un ciclu spiral, apărând pe socoteala vechiului dispărut, noul care se dezvoltă şi reprezintă veriga în evoluţuia continuă a scoarţei terestre. Geodinamica după natura şi originea agenţilor care acţionează asupra scoarţei terestre se împarte în două capitole: Dinamica internă şi Dinaimca externă. Geologia dinamică internă se ocupă cu studiul fenomenelor geologice care se produc sub acţiunea agenţilor interni. După caracterul fenomenelor care au loc ăn interiorul litosferei, această parte a geologiei tratează fenomenele magnetice şi mişcările scoarţei terèstre.

LESSON X

FOSSILS

Fossils are any trace of plants or animals found in sedimentary deposits older than post–glacial. The two most important conditions favoring the preservation of plant or animal fossils are possession of hard partsand rapid burial. Even such soft–bodied animals as jelly have been preserved as fossils, but they are exceptional. Organic remains are preserved in various mays. These are: (1) *Actual preservation* of the organism intact, for example the mammoth elephants found frozen in stream gravels in Siberia. Actual preservation is, of course, extremely rare. (2) *Molds.* After burial the plant or aniimal itself may disappear dueto solution and decay, but the imprint in soft sediments may be preserved. (3) *Casts.* Molds may be filled with some other substance making natural casts similar to castings which are made from molds in a foundry. (4) *Replacement.* Mineral material for instance silica, or other mineral matter may replace the organic remains by bit, faithfully preserving the structure. Perhaps the best known example of this type of preservation is patrified wood. (5) *Permineralization.* Mineral matter, silica or other substances, often infiltrated into the interstices and small voids, where its deposition „patrifies" the remains. (6) *Carbonation.* Plants, by slow decay, often leave carbon films which beautifully preserve the detail of the original material. (7) *Traces.* Animals that walked or crawled across soft sediments left tracks and trails a few of which have been preserved; excreta or various animals also have been occasionally preserved, and such curiosities as gizzard stones have been identified.

Within the last hundred and fifty years, the true nature of fossils as a record of nast life has been accepted by nearly all. A tremendous volume of research on fossils has been accomplished, and at present fossils are useful to the geologie in a number of different ways. By the study of fossils the orderly course of evolution has been

demonstrated. Al though the Cambrian period is the first in which fossils became at all abundant, and the Precambrian rocks are virtually barren of fossils, nevertheless, the stage of evolution at the beginning of the Paleozoic indicates that klife has originated far hack in Precambrian time. For each period of geologic time since the beginning of the Paleozoic era, a characteristic assemblage of fossils has been recognized. Certain life forms had a widespread geographical distribution and only a limited span of existence; some species existed only a fraction of a geologic period. These fossils of short time range, if widespread and abundant, are especially useful as horizon markers. By their recognition it is possible to establish the essential time equivalence of the layers in which they are found, although the exposures may be far apart. It should be emphasized that the sequence of fossil forms has been established by field and laboratory work and does not deepend on any theory. No species once extinct has ever reappeared.

The study of types and distributions of marine fossils has given information on the extent of seas of the different periods. In a similar way land fossils indicate not only land areas, but also connections between them which afforded migration routes. Paleontology thus has helped the geologist in the construction of *paleogeographic maps* which outline in a general way the land and sea areas of a particular time.

Words and phrases

even such soft–bodied animals as = chiar şi animale cu corpuri moi ca
become at all abundant = devin cu adevărat abundente
are vitally barren of fossils = sunt de fapt fără fosile
a limited span of existence = o durată limitată de existenţă
of short time range = o durată scurtă de timp
horizon markes = puncte de reper

EXERCISES

I. *Answer the following question:*

– What are fossils?

– What are the most important conditions favoring the preservation?

– What are the main ways in which organic remains are preserved?

– Which is first period when fossils become abundent?

– What is possible to establish by the recognition of fossiles?

– Are there marine fossils?

What are paleogeographic maps?

II. *Fill in the blanks with prepositions*

Much information is given ... fossils as to the climate ... times ... which thwy lived. The distribution ... Artic types ... Pleistocene sediments far ... the South ... their normal habitat today indicates recent climatic changes ... far reaching effect ... analogy tthe habitats ... certain fossil organisms are assumed to have been similar ... those ... present representatives.

III. *Find synonyms among the following words:*

Definition, wholly, to chill, mode, rapid, bed, entirely, to cool, method, completely, totally, quick, layer, determination.

IV. *Give nouns to the following verbs:*

to trace, to preserve, to favour, to bury, to appear, to replace, to petrify, to identify, to accept, to search.

V. *Form adjectives from the following adverbs and give their degrees of comparison*

fast, slowly, badly, well, strongly, softly, highly, usually, rapidly.

VI. *Translate into Romanian:*

Thus where colonial corals of Silurian age are found in Wisconsin and farther north, in association with other forms also presumed to have been warm types, it many be assumed that the shallow sea which covered the area was relatively warm.

VII. *Translate into English:*

Vieţuitoarele din trecutul geologic al pământului ne sunt cunoscute prin resturile corpurilor sau prin activitatea lor vitală. Aceste resturi constituie materialul esenţial al cercetărilor paleontologice. Păstrarea în sedimente a resturilor provenite de la plante sau animale este condiţionată de anumite procese de fosilizare, prin fosilizare înţelegându-se totalitatea fenomenelor fizice, chimice şi biologice care s-au petrecut după moartea organismelor şi datorită cărora resturile sau urmele acestora se conservă în stratele sedimentare. Pentru ca un animal sau o plantă să se fosilizeze, o primă condiţie este ca după moarte să nu rămână mult timp în contact cu agenţii atmosferici sau de altă natură. Apa, ca şi oxigenul, atacă nu numai părţile organice, dar şi pe cele minerale. Deci, pentru ca un organism să se poată fosiliza, în primul rând, trebuie să fie ferit de acţiunea acestora. Această condiţie nu poate fi îndeplinită decât numai dacă organismele au fost acoperite imediat după moarte, fie de sedimente, fie de apă. O altă condiţie este aceea ca organismul să fi avut în constituţia lui şi părţi dure, scheletice, din substanţe minerale.

LESSON XI

CORRELATION

If there were no soil mantle or complications of structure, metamorphism and intrusion, the correlation, or matching, of the beds exposed at one place with the same or equivalent beds at other localities would be a relatively simple matter. Because of the fragmentary character of the record, however, it is often difficult to match, or correlate, rock formations from exposure to exposure, locality to locality, or from drill hole to drill hole. There are several ways in which correlation may be established: (1) It is often possible to establish the physical continuity of beds over short distances; (2) the discovery of guide fossils is the most certain means of identifying the stratigraphic position of a bed, and establishing its correlatives; (3) within limited areas,

lithologic similarity of beds is often used successfully; (4) like sequences of beds suggest possible correlations, and the more bed involved in the sequence the less chance for error; (5) similarity of insoluble residues of carbonate rocks or of the minor mineral constituents of the insoluble rocks has been useful in establishing correlations.

Other means of correlating rocks are comparisons of the degree of metamorphism, amount of deformation, and number and variety of igneous intrusions present. These are somewhat less satisfactory and less conclusive than the preceding methods. Radioactive age determinations establish general time equivalence but do not establish precise stratigraphic correlation.

The correlation of rocks from place to place often has economic or practical significance. This is particularly true in drilling for water or petroleum. Certain beds may be known waterbearers or petroleum yielders. If the stratigraphic succession has been established in a region and the beds being drilled can be correlated with the equivalent beds in the established succession, the driller knows where he is stratigraphically and can estimate the depth to which he must continue drilling. It is recognized, of course, that thicknesses are variable and erosion may have eliminated some members of the succession. In a similar way the establishment of stratigraphic position of beds is of assistance in forecasting tunneling and mining operations.

It will be noted that the above discussion of the historical significance of fossils and rock characteristics draw largely on analogy with present-day conditions. This can be summed up tersely in the statement that *the present is the key to the past,* as first realized by James Hutton 150 years ago. This is another way of saying that the same processes at work today have acted in a similar way in the past, although it is recognized that the rate of action has varied from time to time. This doctrine of Hutton's is known as the principle of uniformitarianism.

Words and phrases

- drill-hole = gaură de foraj
- like sequence of beds = la fel o succesiune de strate
- amount of deformation = gradul de deformare
- water bearers = purtătoare de apă
- petroleum yielders = producătoare de ţiţei
- is of assistance = este de ajutor
- in forecasting tunneling and mining operations = în amplasarea tunelelor şi a lucrărilor miniere
- draw largely on analogy = se bazează în mare măsură pe analogie
- this can be summed up tersely = aceasta poate fi rezumată concis

EXERCISES

I. *Answer the following questions:*

- Why is it difficult to correlate?
- What are the ways in which the correlation may be established?
- What does the correlation help to?
- What does the establishment of stratigraphic position help to?
- What is James Hutton's statement?
- How is it known?

II. *Give the most suitable Romanian equivalents for the following English word combinations:*

- capable – person; worker; mind; hands
- constant – growrh; development; increase; noise
- strict – rule; teacher; order; discipline
- share – small; large; equal; unequal; fair; great
- sharp – wind; remark; contrast; taste; turn instrument

III. *Give nouns corresponding to the following verbs and adjectives:*

to advise, to lose, to achieve, to share, to divide, to weigh, to repeat, bitter, special, distant, to care, to equal.

IV. *Piek un synonyms among the following words:*

mobile, water course, tiny, spring, profound, small, general, movable, principal, minute, stream, deep, common.

V. *Underline the suffix – ness and translate the words into Romanian:*

compactness, fineness, distinctness, thickness, likeness, greatness.

VI. *Fill in the blanks with suitable words from the text:*

Other means of...rocks are comparisons of the...of metamorphism, amount of deformation, and number and variety of igneous...present. These are somewhat less...and less...than the preceding methods. Radioactive age...establish general time equivalence but do not...precise stratigraphic...

VII. *Translate into Romanian:*

The farther back we go in geological history, the less certain is the interpretation of events. Geology the science dealing with the history of the development of the earth and of life on it, is one of the most ancient branches of knowledge until recently, however, is was a descriptive science which studied the crust of the earth and its fossils and minerals through old methods of comparative natural science.

VIII. *Translate into english:*

Materia se găseşte în permanentă mişcare, trecând în dezvoltarea ei către forme tot mai complexe, mai perfecţionate, iar viaţa nu este altceva decât o formă superioară de mişcare a materiei, care a apărut prin salt calitativ într-o anumită etapă de dezvoltare generală a acesteia. Cu privire la rezolvarea problemei originii vieţii, cercetările făcute se sprijină pe ideea materialistă emisă de F. Engels, care spune că, în dezvoltarea ei, materia vie a apărut din cea fără viaţă în urma transformărilor chimice. După formarea pământului, elementele chimice au intrat în combinaţii, dând compuşi anorganici care, la rândul lor, prin transformări complicate, au dat naştere, mai întâi, la compuşi

organici simpli şi apoi din ce în ce mai complecşi. Prin aceste transformări s-au format substanţe de tipul albuminoidelor, care sunt purtătoare de viaţă. Engels scrie: „Viaţa este modul de existenţă a corpurilor albuminoide, al cărui moment esenţial este schimbul continuu de substanţe cu natura externă înconjurătoare".

LESSON XII

THE PRECAMBRIAN AND THE PALEOZOIC

The Precambrian. Radioactive determination of age show that the earliest rocks with abundant fossils date back at least 500 million years. Similar age determinations reveal an age of some 2.5 billion years for the oldest rocks yet identified. Because all of the time before the beginning of the Paleozoic Era is included in the Precambrian, the latter therefore includes about 80 per cent of known time. How much older the earth is than the oldest rocks studied is a matter of pure conjecture. For several reasons the Precambrian history of the earth has not been worked out in the same detail as that of the following eras. In the older Precambrian, the rocks are highly deformed, intimately intruded by igneous rocks, and almost barren of fossils. In the latter Precambrian, more detail has been achieved in orking out the record.

Precambrian rocks are of the same types as those of more recent dates, showing that the same processes active today were acting then in the same way with similar results. Volcanic activity was widespread and abundant. Thicknesses of from 10 to 20 miles of Precambrian sedimentary formations have been studied at various places. This does not mean that at any one locality a sequence of 50.000 to 100.000 feet of Precambrian sediments has been established. It does mean, however, that by piecing together bits of the record from regional studies such a thickness is apparent. The figures merely indicate the order of magnitude of sedimentary formations

of Precambrian age. During the Precambrian, there were at least three times of widespread orogeny, or mountain making, and accompanying widespread igneous invasions. Because of universal deformation and extensive intrusions, the early record fades into obscurity and the early Precambrian are often known as the *basement* or *fundamental complex.*

The Paleozoic. After a long period of erosion, the Cambrian seas crept in over the continents which had been worn down to a relatively low relief in the erosion interval which followed the Killarney Revolution. On North America, seas first occupied great depressions called geosynclines. One of these, called the *Appalachian geosyncline* was located along the site of the present Appalachian Mountains; another, called the *Cordilleran geosyncline,* extended along the site of the present day Cordillera; a third, the *Ouachita geosyncline,* extended from Texas to Alabama. These three seaways were more or less persistent features of the Paleozoic landscapes. At times they were filled with water, and at times they were drained. They were the loci of the heaviest Paleozoic sedimentation and in the Appalachian geosyncline about 30.000 feet of Paleozoic sediments were deposited. Because the sediments were dominantly of shallow-water type it follows that subsidence of geosyncline about kept pace with deposition or vice versa. During most of the Paleozoic, a highland area, *Appalachia,* lay to the east of the Appalachian geosyncline.

Words and phrases

- date back at least = datează de cel puțin
- for several reasons = din mai multe motive
- has not been worked out = nu este cunoscută
- in working out the record
- the early record fades into obscurity
- which had been worn down to = care au fost reduse la
- it follows that = urmează deci
- kept pace with = a mers în paralel cu

EXERCICES

I. *Answer the following questions:*

– What does the radioactive determination show?

– Is the Precambrian history known in the same detail as the following eras?

– What does the similarity between Precambrian and recent dates rocks show?

– Why the early Precambrian rocks are known as the basement or fundamental complex?

– What is characteristic to the Paleozoic?

II. *Write with letters:*

1965; 22,497; 53,891; 306,712; 1.374.001.

III. *Pick up antonyms among the following words:*

movable, shallow, inner, fixed, deep, outer, immobile, motionless, ancient, useful, modern, useless.

IV. *Write the adjectives corresponding to the following nouns:*

mountain, continent, ocean, porosity, distance, geology, pole, value, product, metamorphism, sedimentation, sand, water.

V. *Form compound adjectives by combining the following adjectives and nouns. Translate them into Romanian:*

large, big, bare, dark, ill, absence, long, broad, high, steep, valley, rock, mountain, colour, road, landscape, mind, eye, head, temper, friend, room.

VI. *Ask questions to which the following answere may be given:*

– Mantle rock, which ranges in thickness from a few inches to hundreds of feet, consists of clay, sand, gravel, and other loose material.

– The essential feature of the stratified rock is its arrangement in layers.

– Minerals are substances having definite chemical composition and usually of crystalline structure.

– Silt and clay are sediments composed of the finest-grained products of erosion.

– There are two broad classes of sediments: 1) detrital sediments, and 2) sediments separated from solution.

VII. *Translate into Romanian:*

This complex is unique in that it is the only sequence of rocks thought to be universally distributed over the surface of the earth. Everywhere on the earth's surface, rocks of the fundamental complex underlie all rocks that have been subsequently deposited except possibly where wiped out entirely by later intrusions which rose from deep within the earth.

VIII. *Translate into English:*

Numele acestei perioade, propus de Sedgwick în anul 1835, vine de la Cambria, numele latin al Ţării Galilor, ţinutul unde au fost recunoscute şi separate întâia oară de acest cercetător, formaţiunile care i se atribuie. Aceste formaţiuni erau considerate atunci ca având cele mai vechi resturi de vieţuitoare. Tendinţa a fost la un moment dat, după exemplul lui Murchison, ca formaţiunile ce intră în cadrul acestui sistem să fie înglobate cu gradul de serie în sistemul următor. Însă, după ce s-a pus în evidenţă diferite regiuni caracterele de individualitate ale ansamblului formaţiunilor respective, punctul de vedere al lui Sedgwick a prevalat, aşa că astăzi majoritatea geologilor consideră Cambrianul ca un sistem bine distinct de Silurian.

LESSON XIII

THE MEZOZOIC AND THE CENOZOIC

In the Triassic period a peculier series of elongate fault troughs was formed along the eastern seaboard, which extended discontinuously from the Bay of Fundy to the Carolinas. In the Connecticut valley trough, an estimate thickness of 10.000 to 13.000 feet of bedrock called the *Newark series* was deposited under land conditions. Along the troughs, also, lava flows are associated with the sediments and

many basic dikes in the eastern section are thought to be of Triassic age. In the western part of the country, the great coast range batholith, which extends up the Canadian coast 1100 miles northward from the state of Washington, was intruded in the Jurassic or Cretaceous. The Serra Nevada batholith of California and the Lower California batholith were also intruded in the Jurassic or Cretaceous. These intrusions of Mezozoic times are the greatest since Precambrian Extensive volcanism was widespread also.

Mild climates prevailed throughout most of the Mesozoic. Distribution of cold-blooded reptiles and of tropical or subtropical types of plants demonstrates the geniality of Mesozoic climate even in high latitude. Red sandstones of eolian deposition in Utah and Arizona and Gypsum deposits of the Rocky Mountains states (Triassic) indicate at least local aridity.

From the preceding brief account of the physical changes undergone by the earth, it may be seen that the earth's surface is not static but is subject to continual changes. Measured in terms of human history, the changes are alight. Over the span of years embraced in even a single geological period, however, vast changes have taken place. Between the Precambrian and Pleistocene epochs of refrigeration, other ice ages have occurred. Glacial climates, however have been exceptional, and during much of geologic time the climate of the earth was certainly more uniform and warmer than at present. Although the earth has undoubtedly been losing heat by radiation, there seem to have been a compensating internal source of heat. Of the climate record it can be said that within geologic times, at least, there has not been a progressive cooling. The erosional processes at present are lowering the continents at an average rate of one foot in five to six thousand years. Similar erosional processes have levelled mountain ranges and worn the lands low through many erosion cycles of the past. It is at once evident that were it not for internal energy finding expression in diastrophism and volcanism which offsets the effects of denudation, the land areas logn ago would have been reduced

approximately, if not entirely, to sea level. What the sources of internal energy may be the geologist is not yet in position to state. Perhaps the most reasonable explanation that can be offered at the present time is radioactive generation of heat. At any rate, the form of the continents was apparently blocked out very early in the precambrian and in spite of the many encroachments of shallow seas, the continents themselves have been persistently positive. Deep-sea sediments are virtually unknown above the oceanic level, and there is but little evidence of any major transformation of continental areas into deep-sea zones. This is another way of stating that the continental masses and oceanic segments, with only inor exceptions, have been differentiated throughout the geologic record.

Words and phrases

northward = spre nord
mild climates prevailed throughout most of = clima blândă care a predominat cea mai mare parte din...
from the preceding brief account = din scurta prezentare precedentă
over the span of years = în răstimpul de ani
at an average rate = cu o viteză medie
it is at once evident = se observă imediat
at eny rate = în orice caz
in spite of = în ciuda

EXERCISES

I. *Answer the following questions:*

– What is peculiar to the Triassic period?
– What kind of climate prevailed in Mesozoic?
– Which were the reptiles and plants in the above mentioned period?
– What is the earth's surface subject to?
– How has the climate changed since the Precambrian?
– How do the erosional processes act upon the continents?
– Which is the influence of the radioactive generation of heat?

II. *Look at the map of our country and point out the countries that border it according to the directions:*

North-South – East-West; Northern-Southern-Eastern-Western Northward-Southward-Eastward-Westward.

III. *Write with letters the following numbers and read them aloud:*

13; 30; 303, 13; 313; 5; 15; 50; 9; 99; 987,654

IV. *Give the most suitable Romanian equivalents for the following English word – combinations:*

to move along; to come along; all long; along shore, fatherland, to land on the sea, lansfall, landmark, landscape, waterfall, to have a fall, a heavy fall of rain, fall of the leaves.

V. *Give synonyms to the following words:* to extend, layer, to intrude, to undergo, certaubly, undoubtedly, evident, at once, at any rate, to state.

VI. Un*derline and comment the means of affixation in the following words:*

discontinuously, thickness, eastern, western, certainly, slowly, undoubtedly, northward, southward, changeless.

VII. *Translate into Romanian:*

This complex is unique in that it is the only sequence of rocks thought to be universally distributed over the surface of the earth. Everywhere on the earth´s syrface, rocks of the fundamental complex underile all rocks that have been subsequently deposited except possibly where wiped out entirely by later intrusions which rose from deep within the earth. In contrast to the eocks of early Precambrian, however, except in belts of strong folding, the rocks of late Precambrian are only mildly deformed and are subhorizontal.

VIII. *Translate into English:*

În concepţia actuală, Grupa mezozoică cuprinde un pachet de formaţiuni cu o grosime de multe mii de metri? în care rolul principal,

ca răspândire şi dezvoltare, îl deţin calcarele, marnele şi dolomitele. Alături de acestea, dar de o importanţă şi într-o proporţie mai redusă, se găsesc gresii, şisturi argiloase, argile, etc. pe când cuarţitele, grauwackele, şisturile silicoase, şisturile argiloase întărite etc., care aveau o mare preponderenţă în seria formaţiunilor din Grupa paleozoică, de astă dată sunt rare. Spre deosebire de cele primare, formaţiunile Grupei secundare se caracterizează din punct de vedere tectonic prin faptul că, afară de zona catenelor terţiare, unde sunt intens dislocate, ele sunt puţin deranjate din poziţia lor iniţială, astfel încât de cele mai multe ori sunt orizontale sau uşor ondulate.

LESSON XIV

GEOLOGICAL STRUCTURES

All rocks masses have some features or designs called *structures*. The study of the arrangements and significance of these constitutes the field of geology termed *Structural Geology*. To the engineer, miner, and quarryman geological structures are of direct concern because the ease, method, and cost of excavation depend in part upon the structure of the material. Mary surface features of the earth are related to structure, and the cpurse and movement of underground water are, in a large measure, influenced by structure.

Various types of structures can be recognized. Broadly these are classed as primary structures and secondary structures. *Primary structures,* for exemple, stratification of sedimentary rocks, are those structures formed at the same time as the rocks mass itself or during its consolidation. Both sedimentary and igneous rocks have primary structures, and many of their metamorphic derivatives display primary structures which were not obliterated during the rocks alteration. Secondary structures are those produced during the post-consolidation history of the rock. *Secondary structures* include such features as folds, warps, rock cleavage, and many types of fractures.

Although some oartsof the earth´s crust have been more stable than others during the long course of earthh history, the internal forces of compression or uplift have affected all land areas, and probably all parts of the sea floors. Largescale earth movements are termed *diastrophism.* Diastrophism includes two types of movement, epeirogenic and orogenic movements. The first of these, *epeirogenic* movements, are domimantly vertical, up or down movements, which involve considerable area but do not cause much deformation. Orogenic movements are those in which the horizontal composent of displacement is considerable. They result in folding, mashing, and breaking of the rock masses involved. There are, of course, all degrees of deformation which range from the intense crumpling and squeezing of mountain zones to the scarcely perceptible warps of plains and plateau areas.

Words and phrases

quarryman = muncitor într-o carieră
of direct concern = interesează direct
large scale earth movements = mişcările de pământ intense
broadly = pe larg
up or down movement = mişcări ascendente şi descendente
intense crumpling = fracturare intensă
scarcely perceptible = abia perceptibile

EXERCISES

I. *Answer the following questions:*

- What is structural Geology dealing with?
- What does structure influence?
- How are structures broadly classed?
- When did the structures take place?
- What are the secondary structures?
- What is diastrophism and what does it include?
- What are the results of organic movements?

II. *Fill in the blanks with suitable words from the text. Translate the text.*

Strom distturbances and river floads, as well as positive and negative... of the floors on which the ... are deposited, also give rise to irregularities of grading. Thus it is the ... vary not only ... but also ... . Minor structural ... of sediments have already been described. The structure formed during ... and consolidation of ... rocks and those formed during the hardening of igneous ... are useful indicators of the ... under which the rock was formed and ...

III. *Give adjectives corresponding to the following nouns:*

structure: significance; water; stratification: consolidation; history; stability; strength; truth; dependence.

IV. *Give as many derivatives as you can of the following words:*

to depend; to produce; to change; to determine; to stratify; to relate; to direct; to differ; to break.

V. *Give the principal forms and the Romanian translation of the following verbs:*

to arise; to bear; to beat; to become; to cost; to catch; to cling; to cleave; to deal; to dig; to draw.

VI. *Translate into Romanian:*

The primary fracture patterns of igneous rocks consist of joints or faults developed by the stresses associated with intrusion or consolidation either prior to or just after complete consolidation. Tension joints, normal to elongation, and hence normal to flow structure if that is present, are abundant. MInor inward and cutward directed faults or breaks caused by the upward or cutward thrust of the intrusive mass are found in many intrusions.

VII. *Translate into English:*

Convenţional, după unii autori, geotectonica se împarte în trei: morfologică (sau geologia structurală); regională şi generală. Aceasta din urmă se subîmparte în geotectonica generală istorică, geotectonica generală mecanică (sau geomecanica) şi geotectonica generală

tectonică. Toate aceste ramuri sunt strâns legate între ele şi adesea este foarte dificil să se traseze o limită între subdiviziunile sus amintite. Geologia structurală studiază formele structurale ale rocilor, stabileşte tipurile principale de forme structurale, le clasifică şi caută să lămurească cauzele apariţiei lor. Ea constituie începutul şi baza oricărei cercetări geotectonice. Totodată, geotectonica morfologică este partea cea mai bine delimitată din geotectonică şi asupra ei vom insista mai mult, deoarece geotectonica regională şi cea generală sunt subiecte de un nivel mai ridicat, greu de înţeles, atât timp cât geotectonica geomorfologică nu este pe deplin stăpânită.

LESSON XV

PRIMARY STRUCTURES

Primary Structures of Sediments. The most important and universally present structural feature of sedimentary rocks is layering, or stratification. The layering may be due to differences in grain, size, in color, in mineralogical make-up, or some combination of these factors. Air and water carry the bulk of sediment moved from one place to another. Because these are fluid agents which differ in comme enoy from time to time and from place to place, they sort the materials they carry according to size, weight and grain shape hence stratification. Some sediments, however, as those formed by direct ice deposition, are not stratified. The most widespread sediments are those deposited in shallow sens. It follows that the layers or beds were deposited in essentially horinzontal position, Where deposited on sloping bottoms, the strata have an original inclation, or *initial dip*.

Sediments deposited hear shore are generally coarser than those deposited offshore in deeper and quieter water. Varying strength of wave and current and irregularities of offshore slopes, however, at many place prevent uniform seaward gradation of sediments.

Primary Structures of Igneous Rocks. Most igneous rocks display some structures formed during the intrusion or extrusich, or consolidation period. The two principal types of these primary structures are flow structures and fracture patterns.

The primary flow structures consist of parallel arrangements of unequidimentional bodies or particles. Magmatic flow pulls these into parallel or subparallel positions. Oriented particles or bodies of plate-like or tabular shaps, micas, feldspar phenocrysts, schlieren, oriinclusions, give, a *planar flow structure* in which the long and mean axes lie in roughly parallel planes. In many laves, planar flow structure caused by slight differences in viscosity or composition is strongly the direction of magmatic flow just prior to congelation and, in general, is parallel to the contacts or nearest friction exerting surface. Oriented particles of elongate, needle-like or spindle-shaped hodies as hornblends crystals, cigar-shaped inclusions, or steaks of mica or other minerals with the long axes parallel or suparallel, give a *linear flow structure.* Both linear structure and planar flow structure may be present in the same mass, either may occur separately, or both may be megascopically absent. An igneous rock that displays streakiness or banding due to magmatic flow is often called a *flow gneiss.* Igneous rocks with primary flow structure generally split or break more readily parallel with that structure than in eny other direction.

Words and phrases

mineralogical make-up = compoziţia minerală
the bulk of sediment = masa de sediment
it follows that = rezultă că
off-shore = în larg (departe de ţărm)
of plate-like or tabular shape = de formă plată sau lamelată
needle-like, or spindle-shape bodies = corpuri în formă de ace sau fuse.

EXERCISES

I. *Answer the following questions:*

– What is layering?

– How do eir and water act upon the sediment?

– Where are the sediments deposited?

– When were the structures of igneous rocks formed?

– Which are the two principal types of these structures?

II. *Put questions to which the following answers may be given*

– The flanks or sides of folds are called the limbs.

– If the axial plane is vertical, the fold is upright or symmetrical.

– The intersection of the axial plane with the crest or trough of a fold is called the axis.

– The axis may be horizontal or it may be inclined.

– If the failure is dominantly by bending, simple or complex folds result.

– If the failure is dominantly by facture, there are two possibilities.

– The field of geology termed structural Geology

III. *Find English ecuivalents for the Romanian phrases:*

a) cât de mult, în ce măsură; cât de ... cu cât mai mult cu atât mai bine; cât doreşti; cât e până la...?

b) greu de făcut; greu de înţeles; industria grea; somn greu; greu la cap; greu de spus; a munci din greu.

IV. *Give antonyms of the following words formed by adding prefixes*

able; affected; sense; resistant; patiently; passive; polite; possible; capacity; applicable.

V. *Give the past participls of the verbs below, using it in sentences:*

to flow; to break; to strike; to spread; to lay; to mean; to form; to weigh; to split; to occur.

VI. *Translate into Romanian:*

In the steep face of a sandstone quarry or cliff, succesive beds or layers acn be seen, differing from one another by variations in colour or coarseness of grain. At intervals there may be strongly marked bedding planes, along which the sandstone is easidy split, due perhaps to the presence of a thin layer packed with flat-lying flakes of mica, or to the intervention of a thin band of clay or shale. Evidently the beds or strata have been formed by the deposition of successive sheets of sediment. The resulting bedding of stratification is primary structure of sedimentary rocks.

VII. *Translate into English:*

Termenul structură nu are aceiaşi semnificaţie pentru toţi geologii. Pentru unii geologi, structura este sinonim cu forma structurală, adică cu corpurile geometrice formate de roci în scoarţă. Noi vom utiliza termenul de structură atât în sens larg, ca egal cu formele structurale, cât şi în sensul ei mai restrâns. Structurile primare apar în perioada de formare a rocilor şi sunt strâns legate de condiţiile lor de formare. Structurile secundare apar la mult timp după formarea rocilor şi sunt de natură mecanică. Adesea sunt dificultăţi la deosebirea structurilor primare şi secundare şi de aceea mulţi autori nu utilizează această clasificare. Deoarece structurile primare depind de condiţiile de formare a rocilor, rezultă că structurile primare ale rocilor sedimentare diferă de cele ale rocilor eruptive. În cazul rocilor metamorfice, acestea moştenesc structurile rocilor din care provin.

LESSON XVI

SECONDARY STRUCTURES
FOLDS AND FAULTS

Folds. Folds vary from slight flexures of simple outline to intricate folds made up of many minor folds. Scale, like-wise varies from minute crenulations a small fraction of an inch in length to grand features miles in lenght and several miles across. The primary types

of folds are upfolds, or anticlines; downfolds, or synclines; and abrupr flexures or changes of inclination of horizontal or uniformly inclined beds known as monoclines. Anticlines and synclines are commonly complementary. If, as has happened at many places, folds are eroded, older beds appear in the central part of eroded anticlines than at the outsides; in eroded synclines, the younger beds appear in the central part of the structure.

Principal parts of folds. In the study of folds it is convenient to reoognize a number of fold elements or principal parts. These are the limbs, axial plans, and axis.

Faults. Fracture surface along which mivement has occurred are termed faults. Some are clean sharp breaks. Many, however, are composed of subparallel faults among which the total displacements have been distributed. The terms shear zone or fault zone are often applied to closely spaced subparallel structures along which there has been distributive movement. Some fault, even large ones, are knife-masses sliding over one another, break or crack (brecciate) the rock on either side of the rupture. Still other faults pulverize the rock in the fault zone to clay-like powder called *gouge.* Conventionally, the surface of the rupture along which relative movements have taken place, are termed *fault planes.* Most fault surfaces, however, are warped or curved and irregular in detail; the term *fault surface* is preferable to *fault plane.* The movement along or on the fault surface may be in any director, and the total displacement on many faults is a cumulative result of intermittent dislocations. Indeed, spasmodic movements along many faults are continuing to the present, as witness the desplacements along the San Andreas River within the present century.

Words and phrases

slight fleaxures = cute slabe
intercate folds = cute complicate
grand features = caractere majore
clean sharp breaks = fracturi tranşante

closely spaced subparallel structures = structuri subparalele strâns apropiate
knife masses = lambouri tăiate
clay-like powder = pulbere asemănătoare argilei.

EXERCISES

I. *Answer the following questions:*

– What are the principal secondary structures?
– What are folds?
– How do they vary?
– Which are the primary types of folds?
– What are faukts?
– What is the shear zone?
– What are fault planes?
– What is the direction of the movements along or on the fault surface?

II. *Fill in the blanks with prepositions (or adverbs) when required:*

As has stated, rock masses subjected ... overpowering stresses yield or, ... the engineering sense, fail ... various ways. Indeed, the manner ... which rock masses accomodats themselves... overpowering stresses is not fully understood. The results ... failure ... terms ... rock structures, however, can be reduced ... rather simple terms. Folding of sediments takes place ... several different means ... accomodation... stress ... many folds, there has been a slip or shear ... the layers.

III. *Give the principal forms of the following verbs:*

to awake; to begin; to bend; to catch; to chose; to dup; to draw; to fall; to give; to grow.

IV. *Build up sentences with the above verbs using all three forms.*

V. *Substitute the underlined words by corresponding synonims*

In the *field,* a *variety* of materials are *observed,* some of which are *classed* as rocks and *some of which* are clased minerals. In ordinary conversation, however, the *term* rock in generally *restricted* to those substances which are firm and coherent. If a handful of beach sand is *carefully* examined, it will be *noted* that it is *composed* of a *variety* of individual grains, many of which may be white, but some of which may be blanck, red, or other colour.

VI. *Translate into Romanian:*

A fault is a fracture surface along which the rocks have been relatively displaced. Verical displacements up to many thousands of feet and horizontal displacements up to the tens of miles are well known, but in none of these is there any reason to suppose that the total movement occurred during a single super-catastrophe. Erathquakes result from sudden movements along faults, but the displacements are rareky more than a few feet at a time. Even so, it is obviously of vital importance that engineering structures, such as great dams and lengthybridges, should not be constructed across faults that are still active.

VII. *Translate into English:*

Structurile secundare apar după formarea rocilor, din cauza mişcărilor tectonice. Schimbarea (modificarea) structurii scoarţei, adică a repartiţiei diverselor roci, sub influenţa cauzelor tectonice, se numeşte dislocaţie. Sub influenţa forţelor tectonice, corpurile geometrice, formate din diverse roci în scoarţă, îşi schimbă forma, luând naştere noi corpuri geometrice. O asemenea schimbare poate avea loc păstrându-se continuitatea rocilor, sau, din contra, aceasta să fie afectată. În primul caz, dislocaţia se numeşte plastică, iar în al doilea, rupturală. În cadrul dislocaţiilor plastice intră cutele, iar în cel al dislocaţiilor rupturale, fracturile. Structurile secundare pot fi împărţite, după ordinul de mărime, în structuri secundare locale (cute, fracturi etc.) şi structuri secundare regionale (zone cutate, zone necutate = platforme).

LESSON XVII

GEOPHYSICAL EXPLORATION METHODS

In regions of many outcrops, where the stratigraphic sequence and structure can be determined satisfactorily from surface exposures, there is little need of sub surface exploration. In other regions, however, specially those of few outcrops and slight relief, supplementary information is essential. The engineer requires specific and detailed information on local conditions. Although a regional history and a satisfactory concept of regional structure may be obtained from surface observations, the necessity for thorough exploration of the materials in which or on which engineering construction is to be undertaken is so apparent as to need little comment. Intelligent design and safe, economical construction require thorough appreciation of subsurface conditions. The objectives of subsurface exploration are, consequently, quantitative data on the kinds, properties, amounts, distributions and structure of the material under and adjacent to a proposed structure. Two groups of methods are available whereby these date may be gathered. The first of these groups involves direct penetration of the materials. This is possible by means of various types of drills. The second group of methods involves making and interpreting certain physical measurements from the surface without direct penetration. The two approaches are not mutually exclusive, and in practice generally are combined with excellent results. This chapter is concerned with the indirect, geophysical, methods of subsurface exploration. This discussion is not a technical treatise on the techniques of subsurface exploration; the aim is to direct attention to geophysical methods of their application to engineering problems.

Geophysical Methods

Geophysical exploration consists of measuring, from the surface, certain physical properties of the underlying material, and of interpreting the measurements in terms of geological structure and lithology. It is emphasized at the start that the data of geophysical

measurements are valuable to the engineer only when correctly interpreted in geological terms. The properties investigated by the physical measurements are density, elasticity, electrical conductivity, and magnetism. Divination, as practiced by „water witches" (dousers) and some mineral prospectors, makes no measurements, furnishes no quantitative data, and is not a geophysical method. Its practice and use are left to those of mystic mind, credulous ignorance and with faith in the occult.

The four principal methods of geophysical exploration are: gravitational, magnetic, seismic and electrical. Of these, seismic and electrical methods have the widest range of application in civil engineering practice.

Words and phrases

stratigraphic sequence = succesiunea stratigrafică
slight relief = relief slab
is so apparent es to need little comment = este atât de evident încât comportă puţine discuţii
under and adjacent to a proposed structure = sub şi în vecinătatea unei structuri propuse
the two approaches = cele două posibilităţi (căi de acces)
at the start = de la început
outcrops = afloriment, iviri
water witches (dousers) = căutători de apă

EXERCISES

I. *Answer the following questions:*

– What is Geophysics?
– What is it dealing with?
– Which regions require a thorough exploration?
– How many groups are available whereby certain data may be gathered?
– What does Geophysical exploration consist of?
– What are the four principal methods?

II. *Find nouns corresponding to the following words in the text:*

stratigraphic; determined; requires; detailed; local; parent; economical; quantitative; proposed; direct; possible; combined.

III. *Give antonyme for the following words:*

satisfactory; little; those; few; slight; intelligent; direct; exclusive; excellent; without; valuable; widest.

IV. *Find Romanian equivalents for the English word combinations and word groups:*

to take an interest in; it matters a great deal; it is high time to; nothing of the kind; there is no difficulty about it; to miss somebody, something; to be back at; all over the world; to be on one's way.

V. *Use the verbs in brackets in the tense required by the sense:*

This chapter (to be concerned) with the indirect, geophysical, methods of subsurface exploration. Thus discussion (to be) a technical treatise on the technique of subsurface exploration; the aim (to be) to direct attention to geophysical methods of their application to engineering problems. Geophysical exploration (to consist) of (to measure), from the surface, certain physical properties of the underlying material, and of (to interpret) the measurements in terms of geological structure and lithology.

VI. *Translate into Romanian:*

The principles involved in seismic exploration of the crust can be most easily illustrated by considering the simplest type of case that arises in seismic prospecting. Here the vibrations are provided by artificial explosions, which have the great advantage over natural shocks that they are under complete control and can be used whereve and whenever happens to be convenient. A charge of dynamite is lowered into a shot hole previously drilled to a depth of a few feet. The charge is detonated electrically at an exactly recorded time. The place of origin is exactly known and the depth of focus is negligible.

VII. *Translate into English:*

Concluziile la care conduce utilizarea criteriilor fizico-geologice de apreciere a aplicabilităţii metodelor geofizice de prospecţiune sunt necesare pentru alegerea unei anumite metode într-un caz real dat, dar nu sunt suficiente. Este posibil ca o metodă care principial este aplicabilă din punct de vedere fizico-geologic să conducă la rezultate cărora să nu li se poată garanta autenticitatea din cauza intervenţiei unor agenţi perturbanţi, eliminarea acestora fiind sau imposibilă sau neeconomică. De aceea, hotărârea definitivă de aplicare a metodei respective nu trebuie luată decât după ce s-a făcut aprecierea posibilităţilor ei şi din punct de vedere tehnic şi economic. Succesul efectiv al unei metode geofizice, promis de satisfacerea condiţiilor fizico-geologice de aplicabilitate, poate fi periclitat de perturbaţii de diverse naturi. Prospecţiunile gravimetrice – aplicabile în principiu pe baza existenţei contrastului de densitate şi a dimensiunilor formaţiunii de prospectat – pot fi, totuşi, ineficiente dacă relieful regiunii este foarte accidentat şi cere reduceri de teren care nu pot fi aplicate cu o precizie compatibilă cu cea a aparatelor de măsură şi cu exigenţele formulate faţă de rezultatele finale.

LESSON XVIII

GRAVITATIONAL METHODS

Differences in densities of adjacent rock masses give rise to measurable differences of gravitation. In the outer part at least, the earth is most homogenecus. Hence gravitational measurements often make possible the establishment of boundaries between masses of different density.

Beacuse the earth is a rotating body, slightly flattened at the poles, gravity values vary with latitude. These values also vary according to terrain and elevation. Corrections must therefore be applied to reduce the observed values to a common basis. In reducing observed

values to sea level, the influence of rock masses between sea level and the elevation of the station is taken into account. Anomalies of gravity, i. e. the differences between the theoretical and the corrected, observed values, are represented in plan by contours of equal gravity anomaly values, called isogams, and in section by anomaly profiles.

The instruments. Two types of instrument, pendulums and gravimeters, are used in making direct measurements of gravity values. In pendulum instruments, the period of oscillation is affected by gravity changes. The pendulum method is slow and not adapted to ordinary engineering surveys. Gravimeters are instruments designed to company gravity with the elastic force of springs or wire suspensions. The displacements are magnified electrically or optically. A third type of instrument, the torsion balance, is used suspended from a vertical wire. Beams of various designs with ends weighted are used. To increase sensitivity, the weight of one end may be suspended or the beam tilted. Three types of beam in use are illustrated in Fig. 12.1. In areas where gravity varies from place to place, the beam is deflected from the torsionless position of the suspension wire to a position determined by the unbalanced horizontal components acting on it and on the masses at either end.

Engineering Application. The principal use of the gravitational methods has been by petroleum engineers engaged in subsurface exploration. The outlining of anticlinal structures, buried ridges, and intrusions, and the determination of faults and major subsurface structural trends, constitute the major applications in the field. To a lesser extent, mining geologists have utilized gravitational methods in outlining ore-bearing boddes and structures. The investigation of buried channels has also been carried out. Gravitational surveys, however, at present are of limited use in the practice of civil engineering.

Words and phrases

– to take into account = a lua în considerație
– to give rise = a da naștere
– in its outer part at least = în partea lui exterioară, cel puțin

- instruments designed to compare = instrumente menite (destinate) să compare
- at either end = la fiecare din cele două capete
- the outlining = conturarea
- ore-bearing bodies = corpuri purtătoare de minereu
- to a lesser extent = într-o măsură mai mică
- to carry out = a efectua

EXERCISES

I. *Answer the following questions:*

- What gives rise to measurable differences of gravitation?
- What is the part of gravitational measurements?
- Why do the gravity values vary with latitude?
- According o what factors do these values also vary?
- What are the anomalies of gravity?
- How re they represented in plan?
- What are the instruments to be used in making direct measurements of gravity values?
- Where is engaged the principal use of the gravitational methods?

II. *Build up sentences with the following words:*

to take into account; to give rise; to carry out; to a lesser extent; at either end; in its outer part; the outlining; according to.

III. *Give derivatives of the following verbas and translate them into Romanian:*

to value; ro measure; to design; to differ; to vary; to suspend; to affect; to compose; to determine; to change.

IV. *Add negative affixes to the following words and translate them into Romanian:*

end; flavour; balanced horizontal components; dated; comfortable; certain; doubted; rest; colour; bottom; tirsion; effort; consolidated.

V. *Look up into a dictionary and give the meanings of the following verbs:*

to perfect; to perform; to carry; to perceive; to engage; slide; by; like; beam; deflection; hence.

VI. *Translate into Romanian:*

The values determined by the torsion balance are relative only; however, if the absolute value for one station has been determined, the data may be adjusted, and the contour, or isogamic, map constructed. The presence of faults may be indicated by sudden changes in gradient. One example is shorm, in which the gradient profile and geological section show the clearly defined relationship. The configuration of crystalline rock surfaces buried by sediments has been successfully mapped by this method.

VII. *Translate into English:*

Prospecţiunea gravimetrică reprezintă ansamblul procedeelor de cercetare a structurii subsolului bazate pe studiul variaţiilor de la un loc la altul ale câmpului gravităţii. Aceste variaţii sunt provocate preponderent, dar nu exclusiv, de atracţie gravitaţională datorită maselor de roci care intră în alcătuirea scoarţei terestre, ponderea mare în producerea variaţiilor revenind, în general, rocilor care formează zonele de suprafaţă din subsolul regiunii „prospectate".

Pe lângă atracţia exercitată de formaţiunile dintr-o astfel de porţiune limitată a scoarţei terestre, care este determinantă pentru efectele de variaţie a gravităţii înregistrate în regiunea respectivă de aparatele gravimetrice, indicaţiile acestora sunt influenţate şi de atracţia ansamblului maselor care constituie Globul terestru şi – într-o măsură redusă, dar accesibilă posibilităţilor aparatelor moderne – chiar şi de atracţia Lunii şi Soarelui. Pe de altă parte, în măsurători nu se poate separa atracţia maselor terestre – apropiate şi îndepărtate – sau a maselor extraterestre de efectul forţei centrifuge generate de rotaţia Pământului.

LESSON XIX
MAGNETIC METHODS

Rocks not only vary in density but also in magnetism. Hence, just as gravitational anomalies may be discovered and represented on maps, magnetic anomalies may be determined and used as a basis for interpretation for subsurface conditions.

The earth itself is a giant magnet, with poles far below the surface. The projections of its magnetic poles are near but not coincident with the poles of the axis of rotation. The magnetic force lines of the earth are shown diagrammatically in cross-section in Fig. 12.4. A magnetic needle freely suspended will take a definite position in space, depending on the lines of magnetic force of the earth's field at that place and time. A needle perfectly balanced on a vertical axis before it is magnetized will not remain in horizontal position after magnetism except at points on the magnetic equator. North of this equator the needle inclines to the north; the inclination steepens with increasing distances from the magnetic equator, and the needle will be perpendicular to the earth's surface directly over the magnetic pole. In the southern magnetic hemisphere the dip of the needle is reversed. A counterweight, commonly a silver or brass wire, is adjusted to balance the needle in a horizontal position. The direction assumed by the balanced needle defines the magnetic meridian, and the angle which the magnetic meridian makes with the true meridian at that place is the declination. The declination at any given place, however, is not constant. Long time (secular) changes and annual, daily, and irregular variations are recognized.

Engineering Applications. Both oil and mining explorations have made wide use of magnetic explorations. In fact, more than a million square miles of the United States have been covered by magnetic surveys. Magnetic ore bodies are readily detected. Also, economic minerals, which are not themselves susceptible to magnetic location, may be associated with, or related to, magnetic minerals in such

a way as to make magnetic surveys of value. At places, faults which bring together rocks of different magnetic properties may be diferred from magnetic data as may also folds which alter the elevations of magnetic beds.

Words and phrases

to coincide with = a coincide cu, a fi de acord
just as = aşa cum
related to = legate de
at any given place = la orice loc dat
magnetic surveys = probe magnetice
magnetic ore bodies = corpuri cu minereuri magnetice
magnetic location = amplasament magnetic
counterweight = contragreutate

EXERCISES

I. *Answer the following questions:*

– May magnetic anomalies be determined and used as a basis for interpretation for subsurface conditions and why?

– How are the projections of the earth's magnetic poles?

– What is the magnetic needle definite position in space depending on?

– What are the engineering applications of the magnetic explorations?

II. *Ask questions to which the following answers may be given:*

– Rocks not only vary in density but also in magnetism.

– The magnetic force lines of the earth are shown diagrammatically in cross-section.

– In the southern magnetic hemisphere the dip of the needle is reversed.

– Doth oil and mining explorations have made use of magnetic explorations.

– Magnetic ore bodies are readily detected.

III. *Form compound nouns with the words below:*

contour; counter; force; balance; battle; sharp; cross; magnetic; field; double; safety.

IV. *Fill in the blanks with prepositions:*

Rocks not only vary...density but also...magnetism. The projection...its magnetic poles are...but not coincident...the poles...the axis...rosation. A counterweight, commonly a silver or brass wire, is adjusted...balance the needle...a horizontal position. Also, economic minerals, which are not themselves susceptible...location, may be associated...or related... magnetic minerals...such a way as...make magnetic surveys...value.

V. *Underline the suffix ness and translate the words into Romanian:*

effectiveness; emptiness; expertness; frostiness; fruitfulness; helplesness; looseness; openess; stoutness; willingness.

VI. *Translate into Romanian:*

Three varieties of instruments are in common use. These are dip needle, the Hotchkiss Superdip, and magnetometer. The dip needle consists simply of a magnetized needle mounted on a horizontal axis. This is suspended from the hand and swung into the magnetic meridian, and the angle of dip or inclination is read. The Hotchkiss Superdip is a refinement of the simple dip needle and is desgined primarily for measurements of the total intensity. A nonmagnetic bar with counterweight is fastened to the needle. The centers of gravity of both needle and the counterarm are as nearly coincident with the axis of rotation as possible.

VII. *Translate into English:*

Alături de câmpul gravific, câmpul geomagnetic oferă, prin variaţiile sale de la un loc la altul pe suprafaţa Pământului, posibilităţi remarcabile pentru cercetarea structurii subsolului. Provocate de eterogenităţile distribuţiei proprietăţilor magnetice în diversele formaţiuni geologice care intră în alcătuirea scoarţei terestre – ponderea mare revenind

formaţiunilor situate mai aproape de suprafaţă – aceste variaţii pot furniza informaţii preţioase asupra substratului lor geologic. Totalitatea procedeelor de prindere cantitativă a imaginii anomaliilor în care se integrează variaţiile în spaţiu ale câmpului geomagnetic şi de interpretare a lor în termeni fizici şi geologici constituie prospecţiunea magnetică.

Prospecţiunea magnetică prezintă multe elemente comune cu prospecţiunea gravimetrică. Deşi, fundamentarea ei fizică are caractere specifice, legate în particular de natura fizică a magnetizării – proprietatea fizică a rocilor care prin neregularităţile repartiţiei sale în subsol provoacă anomaliile magnetice – prospecţiunea magnetică are o încadrare matematică aproape identică cu aceea a prospecţiunii gravimetrice.

LESSON XX

ELECTRICAL METHODS

The electoral properties of sarth materials, consolidated or unconsolidated, vary wildely. Generally speaking, rocks, with the exception of the metallic ores, are electrically conductive in proportion to volume, size, continuity and distribution of voids, and void fluids present. Various types of unconsolidated materials differ significantly in voids and contained fluids; and unconsolidated rocks, for exemple sandstone and granite, likewise differ in porosity and fluid content. These differences affect the conductivity or its reciprocal resistivity. The contrasts between consolidated and unconsolidated materials are usually of a higher order than difference within the two groups; hence, electoral exploration for depths of unconsolidated material is generally successful.

Whereas some rock masses, as sulfide ore bedies, give rise to spontaneous electric currents, most electrical exploration for engineering ends is carried on by artificially energizing the ground.

Equipotential Method. If current is introduced into the ground by means of two electrodes, either point or line, current flows between them because of the difference in potential Equipotential lines along which no current flows are traced by two nonpolarized „search' electrodes connected through an emplifier to headphones.

Resistivity Methods. In engineering practice, resistivity measurements have been the most widely employed of the electrical subsurface exploration methods. Where the ground investigations deal with horizontal or low-dipping bodies, resistivity measurements are effective. Measurements of the potential differences about one of the power electrodes or between two can be made, and by supplementing current measurements the resistivity can be calculated. Experience in Kansas shows that determinations of depth to bedrock are accurate to within 10 per cent.

Engineering Applications. Petroleum engineers have used resistivity methods widely and successfully in subsurface structure mapping. Buried anticlines, the most common type of structure favorable to oil accumulation, can be treced by determining depths to strata of greater or lesser resistivity. An example of structural determination by the method is illustrated in Fig. 12–13. In this instance a fold concealed by glacial till brings a limestone of high resistivity near the surface. Another example of engineering application, the determination of rock excavation in a highway out through a till-mantled hill, is shown by Fig. 12-14.

Mining engineers have applied resistivity methods to subsurface structure determination and to the delimitation of certain economic deposits.

Words and phrases

to carry on = a continua
by means of = cu ajutorul, prin intermediul
equipotential line = linie echipotențială
excavation = excavație, cavitate
mantle = manta de protecție, rocă acoperiș;
mapping = cartografie, cartare
in proportion to = proporțional cu.

EXERCISES

I. *Answer the following questions:*

– Are the rocks electrically conductive and in proportion to what factores?

– What are the differences among materials affecting the conductivity or its reciprocal resistivity?

– Why is electrical exploration for depths of unconsolidated material generally successful?

– Is any electrical exploration carried on by artificially energizing the ground?

– What are „search" electrodes?

– What are the resistivity methods in engineering practice and where are they effective?

– Which is the most common type of structure favorable to oil accumulation?

– How can it be traced?

– Can you give some examples of engineering applications?

II. *Ask questions to which the following answers may be given:*

– Various types of unconsolidated materials differ in voids and contained fluids.

– Unconsolidated rocks differ in porosity and fluid content.

– Equipotential lines along which ni current flow are traced by two conpolarized „search" electrodes connected through an amplifier to headphones.

– Where the ground investigations deal with horizontal or low-dipping bodies, resistivity measurements are effective.

– Petroleum engineers have used resistivity methods widely and successfully in subsurface structure mapping.

– Mining engineers have applied resistivity methods to subsurface structure determination and to the delimitation of certain economic deposits.

III. *Give adjectives corresponding to the following nouns:*

success; opulence; consolidation; practice; accumulation; structure; determination; economy; application; appreciation; electricity.

IV. *Form adjectives from the following adverbs:*

widely; favourably; temporarily; highly; gladly; originally; gratuitoualy; favourably;

V. *Use the werbs in brackets in the tense required by the sense:*

In engineering practice, resistivity measurements (to be) the most widely (to employ) of the electrical subsurface exploration methods. Where the ground investigations (to deal) horizontal or low-dipping bodies, resistivity measurements (to be) effective. Petroleum engineers (to use) resistivity methods in subsurface structure mapping. In this instance a fold (to conceal) by glacial till (to bring) a limestone of high resistivity near the surface.

VI. *Translate into Romanian:*

If the grounds were homogeneous and isotropic, the equipotential lines would be symmetrically arranged about the power electrodes. If, however, masses of better or poorer conductivity are embedded in the ground, distorsions of the equipotential lines result. A mass of better conductivity „atracts" the current lines and „repulses" the equipotential curves. A mass of poorer conductivity causes opposite deflections. Determinations of the equipotential lines or potential profiles have been used in the location of ore bodies buried in glacial drift, delineation of structure beneath soil, and location of buried metallic objects. The method is best suited to the study of geologic formations with steep or vertical contacts.

VII. *Translate into English:*

Din punctul de vedere al volumului în care au fost şi sunt întrebuinţate şi al valorii economice a realizărilor de până acum, cele mai importante aplicaţii ale metodelor geofizice de prospecţiune sunt în domeniul zăcămintelor de petrol şi gaze. Până în prezent prospecţiunile geofizice au fost utilizate în acest domeniu aproape exclusiv ca metodę

indirecte, obiectivul lor fiind detectarea structurilor posibil petrolifere sau gazeifere; numai relativ recent, problema prospecţiunii directe a petrolului s-a pus în termeni care să promită soluţii satisfăcătoare. Cum este binecunoscut, prezenţa hidrocarburilor este legată de formaţiunile sedimentare dispuse în aşa-numitele „structuri" ce au luat naştere ca urmare a mişcărilor de deformare a scoarţei terestre. Aceste structuri constituie locaţii favorabile pentru păstrarea petrolului şi gazelor, în porii rocilor care le alcătuiesc. Ele sunt reprezentate fie de anticlinale şi domuri, fie de formaţiuni efilate constituind capcane stratigrafice, fie de locaţie datorite formaţiunilor recifale. Acumulări importante de hidrocarburi se găsesc în legătură cu faliile asociate cu tipurile de structuri menţionate.

SEISMIC METHODS

The elastin proper ies of earth materials vary widely. Seismic methods of geophysical exploration are based on the variation of elastic properties. Differences in the elastic coefficiente of different layers give rise to reflections and refractions of seismic waves, which are treated in the same manner as are the comparable phenomena of geometrical optics.

The instruments are designed to measure and record the speed of propagation of such waves in earth materials. The valocity measurements are designed to measure and record the speed of propagation of such waves in earth materials. The velocity measurements make possible inferences as to the attitude, nature, distribution and structure of subsurface materials.

The speed of the seismic waves in rock is influenced in large measure by the degree of consolidation.

Two methods are of common use in seismic exploration. These are known as reflection shooting and refraction shooting. Reflection shooting is generally used for deep exploration, nommonly greater

than 2000 feet. Refraction methods are better adapted to lesser depth and, since most engineering explorations are of the shallower types, only the refraction method is described here.

Refraction Methods. In refraction determinations, a blasting cap or small charge of dynamite is exploded at or near the surface at a point known as the shot-point. From the shot-point, elastic waves travel outward in all directions. In profiling, detectors (seismometers) are spaced at intervals in line with the shot point (Fig. 12–17). The disturbances, commonly amplified, are recorded photographically on moving film. Time intervals are recorded on the film strip by time lines which are obtained from a tuning-fork device, electrically driven. The tines have peep slits which coincide when the tines are în the neutral position; hence two lines are photographically recorded on the films for each complete cycle. The instant of detonation is electrically transmitted from the shot-point to receivers and is indicated on the film strip. In one method a wire on the blasting cap is hooked up with the galvanometers of the receptors in such a way that when it is broken by the detonation a kick is given to the galvanometers, and the time of explosion is simultaneously recorded on the curves for each receptor.

Words and phrases

in the sume manner = în acelaşi fel
reflection shooting = prospecţiune seismometrică prin metoda undelor elastice reflectate
refraction shootinh = prospecţiune seismologică prin metoda undelor elastice refractate
shallow = puţin adânc, superficial, slab (despre un fund de apă)
blasting cap = explozor; capsă; amorsă
shot point = punct de explodare
tuning = diapazon
device = dispozitiv, aparat
hooked up = încârligat, încovoiat, agăţat
kook-up = unire, împreunare, cuplaj
kick = forţă de reacţie, recul

EXERCISES

I. *Answer the following questions:*

– What are seismic methods of geophysical exploration based on?

– What is the factor determining the reflections and refractiens of different layers?

– What is the part of the instruments?

– What is the speed of seismic waves in rock influenced by?

– What are the methods of common use, in seismic exploration?

– Where are they adapted?

– Can you speak about the refraction methods?

II. *Ask questions to which the following answers may be given:*

– The elastic properties of earth materials vary widely.

– In refraction determinations, a blasting cap or small charge of dynamite is exploded at or near the surface at a point known as the shot-point.

– From the shot-point, elastic waves travel outward in all directions.

– The disturbances, commonly amplified, are recorded photographically on moving film.

– The instant of detonation is electrically transmitted from the shot-point to receivers.

– It is not indicated on the film strip.

III. *Add suitable affixes to the following adjectives and from nouns. Translate them.*

great; high; near; empty; stout; happy; sad; clean; thick; stiff.

IV. *Give the past participle of the verbs below:*

to shoot; to explode; to know; to amplify; to strike; to strip; to strive; to break; to record; to flow; to lift; to set.

V. *Consider the composed words below and explain the way they have been formed:*

ore-bearing bodies; bedrock; counterweight; shot-point; blasting cap; cross-bedding; filtering stone; floatsand; fore-going.

VI. *Fill in the blanks with suitable words from the text:*

The speed of ... in rock is influenced in ... by the ... of consolidation. Two ... are of ... in seismic ... . These are knowp as ... and ... . Reflection ... is generally used for ... . Refraction ... are better adapted to ... and, since most engineering ... are of the ... types, only ... is described here.

VII. *Translate into Romanian:*

The determination of the presence and configuration of more than one refracting layer in depth complicates analysis, but problems involving strata of different elastic properties can be solved. If vertical or nearly vertical boundaries of rock masses of different elastic properties are present, the location of the boundaries can be established. Because a similar cuve might be the result of horizontal differences, another shot at a distance from the first is fired. If the boundary is vertical, the break in the curve remains at the same place whenever the shot may be placed. Of the geophysical methods, those most used in civil engineering explorations are seismic and resistivity determinations of depth to bedrock and exploration of material sources.

VIII. *Translate into English:*

Fenomene în a căror desfăşurare se manifestă eterogenităţile structurii subsolului sunt provocate şi cu ajutorul unor explozii ce dau naştere la unele elastice. Acestea se propagă în subsol şi pot ajunge din nou la suprafaţă, după ce au suferit reflecţii şi refracţii la suprafeţele de discontinuitate constituite de limitele de separaţie a porţiunilor din subsol cu proprietăţi elastice diferite. Ca şi în cazul prospecţiunilor electrice, şi la prospecţiunile seismice este importantă poziţia punctului de observaţie (aici: locul de recepţie, la suprafaţă, a undelor reflectate sau refractate în subsol) faţă de dispozitivul de provocare a fenomenului (în acest caz: punctul de explozie). Oricare ar fi mărimea M (timpul de sosire a undelor reflectate sau refractate, amplitudinea vibraţiilor înregistrate) în determinarea „anomaliei" intervine ca element de prim ordin distanţa dintre punctul de explozie şi punctul de recepţie a semnalului.

LESSON XXII

ORE - DEPOSITS

Ore-deposits are but a special phase of the rock-forming processes already discussed. They have peculiar interest because of their industrial value. An ore is simply a rock that contains a metal that can be profitably extracted. The metal need not preponderate or form any fixed percentage of the whole, for the criterion is solely economic and not petrologic. A gold ore rarely contains more than a very small fraction of one percent of the precious metal, while high-grade iron ore yields sixty-odd percent of the metal. In iron ore, the metallic oxide or carbonate makes up nearly the whole rock.

Concentration. The essential fact in the formation of ores is the unusual concentration of the metal. There are vast quantities of all the metals disseminated through the rock substance of the earth and even throughout the hydrosphere, but they do not constitute ores because they have no economic value. They become ores when concentrated in accessible places to a workable richness. The degree of concentration required is measured by the value of the metal. The essential elements for consideration are, therefore, (1) the original distribution of the metallic materials through the rocks, (2) their solution by circulating waters (or, rarely, by other means), (3) their transportation in solution to the place of deposit, (4) their precipitation in concentrated form, and (5) perheps thei further concentration and purification by subsequent processes.

Exceptional and doubtful cases. There are a few cases where ore-deposits are made by volcanic fumes or vapors, but these may be neglected here. Formerly, ores were often attributed to vapors supposed to arise from the hot interior, but this mode of origin seems incompatible with physical conditions. Ores have been attributed to water originally centained as stoam in laves, and to waters escaping from the interior of the earth, these waters being supposed to be especially mineralized.

Magmatio segregation. In a few instances workable masses of ore seem to have arisen from lavas by direct segregation in the molten state, without the aid of subsequent concentration by water action, on which more ores are dependent. It is not improbable that the segregation of metallic iron and nickel, and other metals, in the deeper parts of the earth may be a prevalent process, giving rise to masses like the native iron found in basalt in Greenland. This iron closely resembles the nickel-irons of meteorites, which may be illustrations of similar action in small planetary hodies that have been disrupted. Metallic masses so segregation presumably gravitate toward the planetary center and hence, whatever their inherent interost, have little relation to a subject whose basal criterion is economic. It is not at all improbable, however, that in the magmatic differentiation of the lavas that come to the surface, there is some metallic segregation that may make the enriched parts effective ground for the concentrating processes of water circulation, and so determine the location of ore-deposits. Igneous rocks are not equally the seats of ore-deposits, even when the circulatory conditions seem to be equally favorable. These conditions may not really be ecually favorable, but there is good ground to believe that some igneous masses constitute a richer field for concentration that others. The basic igneous rocks ere, on the whole, perhaps somewhat richer in ores than the acidic class, but there is no established law. Many acidic rocks bear more and richer ores than many basic ones. The view here entertained is that both classes are subject to regional enrichment though conditions connected with their origin, as yet little known.

Words and phrases

peculiar interest = interes deosebit
solely = exclusiv
to make up = a completa, a acoperi, a alcătui
in a few instances = în câteva cazuri
a prevalent process = un proces predominant, puternic
there is good ground to believe that = este un motiv serios să credem că
on the whole = în întregime, cu totul.

EXERCISES

I. *Answer the following questions:*

– What are ore-deposits?

– Why have they peculier interest?

– What is an ore?

– Which in the essential fact in the formation of ores?

– Do all the metals dissiminated through the rock substance of the earth constitute ores?

– When do they become ores?

– What is the degree of concentration measures by?

– What are the essential elements to be studied?

– What is the magmatic segregation?

– What is the metallic segregation?

II. *Give nouns to the following verbs:*

to disouss; to extract; to gradats; to enrich; to solve; to appear; to purify; to mean; to believe; to constitute; to segregate; to favour; to value; to signify.

III. *Give the English equivalents for the following Romanian combinations:*

cu privire la acest subiect; ţinând seama de toate, dacă trebuie, ce vrei să spui?; vreau să zic; ce înseamnă acest cuvânt; eşti făcut pentru acest lucru; se spune că voi face tot posibilul; în acest scop.

IV. *Give as many derivatives as you can of the following words:*

to construct; to break; to constitute; to effectuate; to disperse; to distil; to solve; to ground; to clear; to clear; to very.

V. *Fill in the blanks with adverbs or prepositions:*

The elastic properties ... earth materials vary ... The instruments are designed ... measure and record the speed ... propagation ... such waves ... earth materials. The speed ... the seismic waves ... rock

is influenced ... large measure ... the degree ... consolidation. Igneous rocks are not ... the sents ... pre–deposits, even when the circulatory conditions sean to be ... favourable.

VI. *Translate into Romanian:*

The form in which mineral deposits occur depends mainly of their mode of origin, their subsequent deformation as the result of crustal movements, and the changes to which they have been subjected by natural weathering agencies. Mineral deposits are conveniently divided into two main classes, syngenetic and epigenetic. Those of syngenetic origin were formed by processes similar, or almost similar, to the processes in operation during the formation of the enclosing rocks, whereas those of epigenetic origin were introduced into pre–existing rocks.

VII. *Translate into English:*

În cursul timpului, clasificarea mineralelor era făcută de către diferiţi mineralogi, ţinând cont de următoarele criterii: forma geometrică pe care o îmbracă mineralele cristalizate, geneza sau modul lor de formare, iar în ultimul timp la baza clasificării mineralelor stau compoziţia chimică şi structura reticulară. Cercetările roentghenometrice întreprinse de un număr mare de învăţaţi au dus la cercetarea unei noi ramuri ştiinţifice – cristalochimia – care prezintă o foarte mare importanţă pentru mineralogi. Prin aceste cercetări s-a dovedit legătura strânsă ce există între compoziţia chimică şi structura cristalelor, de care depind caracterele morfologice, precum şi proprietăţile optice, electrice, mecanice etc., ale mineralelor cristalizate. Toate mineralele din natură care constituie obiectul mineralogiei se împart, după originea lor, în două grupe mari, şi anume: – minerale organice, din care fac parte cu excepţia elementelor native întâlnite destul de rar, compuşii naturali ai tuturor elementelor, cu excepţia celor organici, şi, – minerasle organice, reprezentate prin cele mai variate combinaţii ale carbonului cu diferite elemente.

LESSON XXIII

MAGMAS ROCKS AND MINERAL DEPOSITS

The magma is the direct source of most of the materials of hypogene mineral deposits. Through crystallization and differentiation some constituents collect as crystal aggregated or molten liquids, before final consolidation, to form magmatic oxide and sulphide deposits. Progressive differentiation of silicic magmas results in a residual alkaline liquid that become more and more enriched in the volatiles and other constituents, including metals, that formerly were dispersed throughout the magma. Before final consolidation some or all of this liquid may be tapped off to form pregmatites, whose crystallization leaves an aqueous residue that may form on class of mineralizing solutions. Continued crystallization of the magma produces an aqueous charged with volatiles, metals, and other constituents. When consolidation is complete, or nearly complete, this mobile, nonviscous, aqueous residue may be expelled as hydrothermal mineralizing fluids that later deposit their load to form various types of mineral deposits.

If the consolidating magma is rathern close to the surface, under slight pressure, the volatiles will boil off from the residual aqueous liquid and may reach the surface directly as acid gases, forming fumaroles, such as those of Katmai. They transport and dissipate the metals they formerly collected; no appreciable metallization results.

At less shallow depths, boiling may occur, giving rise to an acid distillated that rises through the fractured rocks. Reactions with the well rocks will cause deposition of some ore minerals. These vapors condense to acid hydrothermal solutions that also woth the minerals ot the wall roch and deposit some of their load. The attack upon the silicates, particulary the basic ones, will render the solutions neutral and finally alkaline, in which condition, after mingling with meteoric waters, they may emerge as juvenile hot springs still carrying the most soluble part of their mineral load.

If the external pressure is greater than vapor pressure of the residual liquid, no vapor phase will result, and the mother liquors will be alkaline liquids, which may he expelled as such to form rising hydrothermal metallizing solutions.

Under deep–seated conditions and high pressure a vapor phase may be absent, and the last residual alkaline liquids, which may or may not contain sufficient concentrations of metal to form economic metallizers, may be tapped off as hydrothermal solutions, or they may be excluded by final crystallization of the residual magma, or they may be absorbed in the formation of the latest rock crystals.

It is thus evident that there are two distinct schools of throught regarding the state of hydrothermal solutions. The first school contends that they leave the magma as gaseous emanations that later condense to hydrothermal liquids from which ores are deposited. Fumaroles attest that such gases do escape and do transport and deposit metals; contact–metamorphic deposits attest that they transport and deposit ores. This explanation offers a simple and likely method for the transportation ofvaluable constituents from the magma Moreover, it accounts satisfactorily for the observed effects of solutions upon wall rocks and constituted a ready means of supplying colloidal silica to hydrothermal solutions.

The other schools are proponents of hydrothermal solutions leaving the magma attenuated alkaline liquids charged with metallic constituents, although the methods of ejection and uprising are left somewaht vague. The arguments mostly advanced ore that hypogene deposits give evidence of having been deposited from hot weters, that juvenile thermal springs are alkaline, and that metals are soluble in alkaline solutions. But, as has been nointed out, some of these arguments loss force since most solutions would eventually become alkaline if in contact with alkaline rocks, and deposition from hot water does not imply that such waters necessarily left the magma as liquide; they may have passed through a vapor phase.

It seems probable that hydrothermal solutions originated in both ways. If the rock pressure is less than the vapor pressure of the residual mahmatic liquors, and the confining rock is opermeable to the high penetrating power of a vapor under pressure, a vapor phase results, later to condense to a liquid phase. If the rock pressure is greater than the vapor pressure the residual aqueous concentrations will be in the state of, and energe as liquid hydrothermal mineralizing solutions.

Words and phrases

more and more = din ce în ce
to point out = a remarca, a semnala
it seems probable that = pare posibil ca
to contend = a afirma, a susţine, a discuta în contradictoriu.
to account = a considera ca; a socoti ca
to account for = a explica, a justifica, a da seama de

EXERCISES

I. *Answer the following questions:*

– What is the direct source of most of the materials of hypogene mineral deposits?

– How are formed magnetic oxide and sulophide deposits?

– When are fumaroles formed?

– What happens when the acid distilated rises through the fractured rocks?

– What happens when the external pressure is greater than the vapor pressure of the residual liquid?

– What happens in case of a high pressure and under deep–seated conditions?

– Regarding the state of hydrothermal solutions, what are the distinct schools of throught?

– What do they contend?

II. *Give synonyms for the following words:*

source; to collect; to break; liquids; formerly; to escape; to transport load; thorough; to emerge; to originate; to exnel.

III. *Form sentences using the verbs in column I ans phraseological combinations in column II. Translate the sentence into Romanian*

I	II
to do	to do one's best
to give	to give rise
to look	to look after
to make	to make out
to account	to account for
to point	to point out

IV. *Use the verb in brackets in the tense required by the sense:*

It ... (to be) thus evident that there (to be) two distinct schools of thought (to regard) the state of hydrothermal solutions. The first school (to contend) that they (to keave) the magma as gaseous emanations that later (to condense) to hydrothermal liquids from which ores are (to deposits). This explanation (to offer) a simple method for the transportation of valuable constituents from the magma. Thus (to seem) probable that hydrothermal solutions (to originate) in both ways.

V. *Give the opposites of the words below:*

dry; liquid; rich; to ignore; to rise; simple; the end; to dissipate; various types.

VI. *Translate into Romanian:*

Sedimentary beds were originally laid down as horizontal or nearly sheet–like flat or lenticular masses, but may subsequently have been folded and faulted by crustal movements. Parallel to their bedding they may extend for many miles, and in thickness may vary from a few inches to hundreds of feet and exceptionally, to many thousands of feet. Epigenetic deposits have a greater variety of forms than the syngenetic deposits, for their mode of occurence has not been controlled to the same extent by the rocks surrounding them. Those which have

been deposited in fissures in preextinting rocks occur as veins, which are usually steeply dipping tabular masses haveing a far greater extent in one direction than at righ angles. The direction of a horizontal line in the plane of the vein is known as its strike;and the vertical angle between a horizontal plane and the plane of the vein, as its dip.

VII. *Translate into English:*

Pe măsură ce magma se răceşte treptat, componentele volatile şi vaporii de apă, datorită tensiunii lor, se degajă din rezervorul magmatic, în rând pe crăpăturile şi fisurile din jurul acestuia. În drumul los spre suprafaţă, dând de temperaturi din ce în ce mai scăzute, atingândpunctul critic al apei (374°C), se condensează, transformându-se în soluţii fierbinţi sau hidrotermale. Din aceste soluţii hidrotermale, care circulă prin crăpăturile şi porii rocilor, se por depune prin cristalizare o serie de minerale de origine hidrotermală, dând naştere la ceamai mare parte a filoanelor de minereuri. Cele mai prielnice condiţii unde au loc procesele hidrotermale se găsesc la adâncimi mici şi mijlocii în scoarţa globului terestru, cam până la 3–5 km de la suprafaţă. Sfera de circulaţie a soluţiilor hidrotermale începe din apropierea părţilor superioare ale rezervoarelor magmatice şi atinge uneori suprafaţa scoarţei terestre. Pe măsura migrării lor înspre suprafaţă, soluţiile hidrotermale întâlnesc un mediu care se îmbogăţeşte treptat în oxigen, presiunea scade până la câteva zeci de atmosfere, iar temperatura coboară de la aproximativ 360°C până la câteva zeci de grade. Aceşti factori influenţează mersul reacţiilor chimice, precum şi natura mineralelor care vor lua naştere.

LESSON XXIV

ORIGIN OF MINERAL DEPOSITS

In this lengthy chapter an attempt has been mads to follow the processes of origin of mineral deposits from the source of the materials to their final resting place as mineral deposits. Magmas are the source

of essentially all of the ingredients of mineral deposits. A few constituents, such as oxygen, carbon dioxidic, or water, are derived from the atmosphere of the oceans, but these also in part are of magmatic derivation.

The initial stages of magma crystallization are attended by separation of certain metallic oxides, sulphides and native metals. Some of these crystallize and become segregated by crystal separation into mineral deposits early in the magmatic stage, other solidify later than the rock crystals and aither become segregated at the original site of accumulation or are injected into the cooled intrusive or the surrounding rocks, forming late magmatic mineral deposits.

During the progressive crystallization of the magma, the abstraction of the early crystallizing rock mineral leaves a residium liquid, generally silicic, which gradually become enriched in volatiles and gases. Thess contain and in part consist of compounds of the metale and other valuable substances formerly sparsely distributed throught the magma; thay tend to collect in the upper part of the magmatic chamber. If the pressure become relieved they escape intothe enclosing wall rock; and under favorable circumstances, contact or pneumatolitic metamorphism ensues, forming contact–metamorphic mineral deposits. The gases and vapors possibly travel farther afield and ferm, by pneumatolitic metasomatism, other of mineral deposits.

Toward the close of the solidification of the magma, some of the accumulated, highly silicic, mother liquors may be withdrawn to form pegmatites, accompanied or followed by aqueous solutions containing valuable compounds from which economic minerals deposited by replacement of âthe pegmatitic minerals. Upon final consolidation of the magma the residual aqueous solutions, in the form of gases, liquids, or both, are ejected toward places of leas pressure. These constitute the mineralizing solutions from which nearly all epigenetic mineral deposits are formed. The gases uponcooling condensa to form magmatic liquids, which as they near the surface mingle with meteoric waters, and many hydrothermal solutions consist

of both. The hydrothermal solutions in their journey outward from the magma chamber undergo chemical change by reaction with the wall rocks and thus become the alkaline solutions from which most economic minerals are considered to be deposited. The solutions seeking lines of easiest flow follow cracks, joints, bedding planes, rock pores, end other openings. The mineral substances in them may replace the rock substances, giving rise to replacement deposits, or they may be precipitated from solution and fill up the rock openings, forming cavity–filling deposits. The deposition may occur t high, medium, and low temperatures and pressures, forming respectively the hypothermal, mesothermal, and epithermal groups pof Lindgren, cach characterized by distinguishing minerals and texture. The magma is thus the parent and mineral deposits the offspring. The offspring may be deposited in sufficient concentrations to constitute economic mineral deposits or they may be sparsely deposited, requiring other means of concentration to render them valuable.

Words and phrases

initial stages = etapele primare
rasting place = loc de odihnă
intrusion = intruziune
sparse = rar, răzleţit
under favorable circumstances = în condiţiuni favorabile
joints = crăpătură de stâncă, falie.

EXERCISES

I. *Answer the following questions:*

– What are magmas?
– What are the constituents of magmatic derivation?
– What are the initial stages of magma crystallization attended by?
– What happens during the progressive crystallization of the magma?
– When are contact-metamorphic mineral deposits formed?

– Which way are all epigenetic mineral deposits formed?
– When do hydrothermal solutions become alkaline ones?
– How have cavity-filling deposits been formed?

II. *Ask questions to which the following answers may be given:*

– The initial stages of magma crystallization are attended by separation of certain metallic oxides, sulphides and native metals.

If the pressures become relieved, the substances escape into the encolosing wall rock

– The gases and vapours form by pneumatolitic metasomatism other types of mineral deposits.

– The gases upon cooling condense to from magmatic liquils.

– The solution seeking lines of easiest flow follow cracks, joints, bedding-planes, rock pores, and other openings.

– The deposition may occur at high, medium, and low temperatures and pressures.

– The magma is the parent and mineral deposits the offspring.

III. *Use the following words and phrases in sentences:*

under favourable circumstances; by every possible means; to some extent; to their final resting place; sparsely; therefore; in addition to; early; nearly; the offspring, to render; toward.

IV. *Form adjectives from the following adverbs:*

sparsely; firmly; finally; possibly; formerly; gradually; nearly; respectively; highly; effectively; mechanically; generally; originally; deliberately.

V. *Underline and comment the means of affixation in the following words:*

drastically; essentially; colourless; unconsolidated; effortless; endless; uncertain; looseness; openness; effectiveness; richness; uncommon; worthless; enrichment.

VI. *Find English equivalents for the Romanian phrases:*

a) În legătură cu aceasta; într-un chip sau altul; fă aceasta oricum; în nici un caz să nu faci asta; nu-mi pasă; ai grije.

b) păstrează-ţi calmul; a rămâne în casă; a continua; trebuie să vă amintiţi; ce-i de făcut?; nimic de făcut.

VII. *Translate into Romanian:*

There are several natural processes by which useful minerals have been accumulated, or become concentrated, to form deposits of economic importance. Some of the chief of these processes will now be described briefly.

Rocks of ineous origin are formed by the consolidation of molten material called rock magma or simply magma. During consolidation the first minerals to crystallize are usually the heavy ones. It does not follow that these heavy mineral will always occur at the base of the consolidated rock. Crustal movemente may force minerals to occupy figures in the surrounding rocks, though almost all deposits formed by direct segregation from the magma are found either in or near the igneous rocks with which they are genetically related.

VIII. *Translate into English:*

Elemente native. În urma studiilor care s-au făcut asupra structurii scoarţei globului terestru, s-a constatat că în această scoarţă se află în stare nativă peste 30 de elemente chimice, în special metale. Majoritatea se găsesc în stare solidă, cu excepţia mercurului, care este lichid. În raport cu greutatea masei scoarţei, greutatea totală a elementelor native este destul de mică, nu depăşeşte 0,1%, din greutatea acesteia. Numărul total al speciilor şi varietăţilor minerale care fac parte din această clasă, după compoziţia lor chimică, este de 80, adică depăşeşte cu mult numărul elementelor care intră în compoziţia lor. Unele dintre elemente se pot afla în două sau mai multe modificaţii polimorfe, ca de exemplu modificaţiile carbonului (diamant, grafit) ale sulfului (sulf şi) etc.

Elementele native întâlnite în stare solidă au structuri cristaline diferite, în legătură cu care stau şi unele proprietăţi diferite pe care le prezintă.

LESSON XXV

Secondary processes may the operate upon the previously formed mineral deposits or upon rocks to form yet other types of economic mineral deposits. Weathering releases many valuable mineral substances that are transported in solution or mechanically to sedimentary basinus and there are deposited as sediments giving rise not only to the common sedimentary rocks but also to deposits of metals and many industrial nonmetallic minerals and products, organic processes also take part in the growth of plants and animals from coal and oil are formed. The inorganic substances were derived originally from igneous rocks and magma, although they may have passed through previous sodimentary cycles. Other soluble substances relesed during erosion are concentrated in bodies of water of the oceans, of anclosed basins, or of the ground water, from which they are deposited by evaporation, givin rise to numerous valuable saline deposits. The circulating ground water is considered by some to be effective dissolving, transporting and redepositing mineral substances in more concentrated form.

Weathering, combined with the sorting action of water and air, effectively garners heavy, insoluble, and durable minerals from their enclosing rock matrix and concentrates them into valuable places deposits of both metallic and nonmetallic minerals. Wathering alone, in its relentless attack upon the rocks, deliberately sorts out valuable and nonvaluable materials. Soluble waste products are remodev from desired insoluble substances, which persist and accumulate in situ as important residual mineral deposits. Other products, such as clays or bauxite, are created during weathering and persist, while associated undesirable substances are removed in solution, leaving accumulated masses as residual deposits of economic importance. Surficial oxidation profoundly modifies most ore deposits, rendering barren the upper parts of many deposits or changing the ore minerals

into more usable or less usable forms. Metals are dissolved within the zone of oxidation, and are then carried down below the water table, where they are precipitated. The metals removed from above are thus added to those existing below, there by bringing about a supergene enrichment of the upper part of the sulphide zone. Leaner parts of veins hays been made richer, and worthless protore has been made workable. Thus have many large and rich ore deposits been created from almost nothing.

Metamorphism not only drastically changes the form and texture of pre-existing mineral deposits but it also creates new ones. Under high pressure and temperature, sided in some cases by hot eaters, metamorphic minerals that are stable under the new environment are produced. The change may consist only of necrystallization, or of recombinations of materials to from the new minerals. Generally nothing, except perhaps water, is added during the metamorphism.

It is evident that the types of economic mineral deposits are many and varied and that numerous and unrelated geologic processes must be involved to explain their origin. Four major processes operate to produce mineral deposits, namely, igneous activity, sedimentation, weathering, and metamorphism.

In certain cases more than one process is involved, and these may overlap or operate at different periods of time. In the deciphering of the genesis of mineral deposits, and in the application of the deductions therefrom, it is imperative that multiple working hypothese be utilized. The student of economic geology must not only have at his command a knowledge of the other geologic sciences, but he must apply them to the problem of ore genesis.

Words and phrases

weathering = alterarea rocilor
weatherworn = alterat
rock matrix = rocă-mamă
waste products = rămăşite
thereby = în acest fel, în apropiere, pe acolo

from almost nothing = din aproape nimic
to overlap = a domina; a fi aşezat în straturi
to decipher = a descifra.

EXERCISES

I. *Answer the following questions:*

– What are the processes operating upon the previously formed mineral deposits?

– How have the other types of economic mineral deposits been formed?

– Where are coal and oil originated from?

– Where are inorganic substances derived from?

– How have saline deposits been formed?

– What is the action od weathering combined with the sorting action of water and air?

– What is the action of weathering alone?

– What are the other products created during weathering?

– What is the action of surficial oxidation?

– How have metamorphic minerals been produced?

– What are the major processes operating to produce mineral deposits?

II. *Form sentences using the verbs in column I and phraseological combinations in column II Translate the sentences into Romanian.*

I	II
to run	to run after
to think	to thin over
to come	to come about
to go	to go through
to stand	to stand off
to leave	to leave out

III. *Find nouns corresponding to the following words:*

to weather; rocky; to solve; to persist; effective; to grind; profundly; to load; to decipher; to environ; significant; to solidify; to follow; to eject; mineral.

IV. *Give some verbs with the same meaning of the verbs below:*

I	II
to effect	to permit
to calculate	to give rise
to fail	to enter
to value	to filter
to desirs	to leave
to accumulate	to increase

V. *Add negative affixes to the below:*

regular; worth; motion; favourable; rest; separated; use; real; like; tidy; aim; breath

VI. *Fill in the definite or indefinite article where required.*

Magmas are... source of essentially all of ... ingredients of ... mineral deposits. During ... progressive crystallization of ... magma, ... abstraction of ... early crystallizing rock minerals leaves ... residium liquid, generally silicic. Upon final consolidation of ... magma ... residual aqueous solutions in ... form of gases, liquids, or both, are ejeczed toward places of less pressure ... magma is thus ... parent and mineral deposits ... offspring.

VII. *Translate into Romanian:*

Many mineral deposits have undergone considerable changes since they were first formed. Thess changes have been caused mainly through the agency of descending surface waves and are termed „sunergene changes" to distinguish them from the „hypogene" effects produced by ascending hydrothermal solutions. Particularly important and interesting are the supergene processes to which some cooper deposits

have been subjected, with the result that they show characteristic changes from the surface downwards. Usually, the sulphide or iron, pyrite, is present in cooper ores. This mineral is very unstable, being easily decomposed by oxygenated waters into the reddish-brown iron mineral, limonite, with the liberation of sulfuric acid.

VIII. *Translate into English:*

Majoritatea elementelor native cristalizează în sistemul cubic (aur, argint, cupru, platină, fier, carbon (diamant), cu excepţia sulfului, care cristalizează în sistemul rombic (sulf) şi monoclinic (sulf); carbonului (grafit), în sistemul hexagonal, şi arseniului, romboedric. Unele dintre ele (aur, argint, cupru) se pot prezenta sub formă de dendrite sau plăci cu aspect reticular, foiţe subţiri, forme de muşchi sau sârme. Culoarea majorităţii elementelor native este argintie sau asemănătoare culorii staniului, cu excepţia aurului şi sulfului, care sunt galbene; cuprul are culoare roşie-arămie, arsenul este cenuşiu, carbonul este cenuşiu (grafit), iar varietatea diamant este incoloră sau divers colorată. Luciul este metalic puternic, în special după suprafeţele şlefuite, încât prezintă cea mai puternică capacitate de reflexe dintre toate mineralele. Indicii de refracţie de care depinde luciul sunt dintre cei mai mari (diamant) cu excepţia aurului, argintului şi cuprului, care au indici mai mici de 1, cu toate acestea, capacitatea lor de reflexie este mare. Duritatea elementelor native este în general mică, cuprinsă între 1 şi 2 (grafit, sulf); 2,5 şi 3,5 (aur, argint, cupru, arsen); 4 şi 5 (fier, platină), iar diamantul face excepţie, având duritatea 10; de asemenea iridiul, care are duritate mare.

GEOLOGY

VOCABULARY

A

accuracy = exactitate; precizie
acline = strat orizontal
alter = a (se) schimba
alum = alaun
angle of bedding = unghi de stratificaţie
angle of elevation = unghi de urcare pe pantă; unghi de elevaţie
slope angle = unghiul talazului
faulted anticline = anticlinal faliat
acueous = apos; acvifer; saturat cu apă
arch = arc; boltă; anticlinal
arenaceous = arenaceu; nisipos; grezos
ash = cenuşă; conţinut de cenuşă
aspirating = aspiraţie
assumption = ipoteză; premisă; supoziţie
available = disponibil; accesibil; existent
average = medie

B

bar = filon transversal; bară; tijă; rangă; prăjină
barren = steril; neproductiv; arid
batching = dozare
weight batching = dozare gravimetrică
batt = argilă şistoasă
bay = golf; bazin de apă
bearing of trend = întinderea stratului; direcţia stratului
thrust bearing = lagăr axial; crapodină
bed = strat
lower bed = strat-talpă; pat; strat inferior
overlying bed = strat protector; strat superior
upper bed = strat superior
bind = şist bituminos
blanket = îmbrăcăminte rutieră; pânză de filtru-presă
blast = explodare; împuşcare
blend = amestec
bond = legătură atomică; legătură
bore = foraj; săpare; gaură de sondă
brass = alarmă; cuzinet; bucşă
break = fisură; fractură; rupere
bulk = volum; capacitate
burial = îngropare

C

cap = cap; capsă
blasting cap = explozor; capsă; amorsă
carrier = purtător; transportor

cave, blaster = peşteră vulcanică
caved = surpat
chalk = cretă
change = încărcătură
charting = cartare
clay = argilă
cleaving = scindare, despicare
cliff = pantă; terasă; stâncă; faleză
coal = cărbune
coarse = brut; grosier
coarse-grained = macrogranular; cu granulaţie mare
coat(ing) = înveliş protector
compass = busolă; compas
computation = calcul; estimare; calculare
conuate = relictic; veteric
cooling = răcire
copper, soldering = ciocan de lipit
creck = fisură; crăpătură
crevice = crăpătură; fisură; crevasă
crooked = curbat
crop = a aflora
cross-bedded = stratificat în diagonală (încrucişat)
cross-bedding = stratificare diagonală (încrucişată)
crude = ţiţei brut
petroleum crude = ţiţei brut
crumble = a fărâma; a sfărâma
crush = sfărâmare; concasare

D

dam = dig; baraj
data, geologic(al) = date geologice; coordonate geologice
deep = adâncime; adânc
degree = grad
depth = adâncime; grosime (a stratului)
desert = deşert; pustiu
detection = detectare; descoperire
dioxide, carbon = bioxid de carbon
dip = înclinare; pantă
dip at high angles = înclinare mare
dip at low angles = înclinare mică
displacement = dezlocuire; deplasare
disturbance = dislocare; deranjament; perturbare
downward = descendent
drain = drenaj; molire
drop = cădere; pantă; picătură

E

earth = pământ
earthquake = cutremur de pământ
edge = margine; marginal; tăiş
elevation = înălţime; cotă; nivel; ridicare; profil
ground elevation = cota terenului
embankment = dig; baraj
enclosed = blindat; închis
engineer = inginer
engineering = tehnologie; tehnică
enlarge = a lărgi; a extinde
enrich = a îmbogăţi
escape = degajare; emanaţie; ieşire
estimating of gas reserves = evaluarea rezervelor de gaze
events, seismic = fenomene seismice
exhausted = epuizat; uzat

F

factor = factor; coeficient
failure = dislocare prin oboseală (a rocilor)
fall = surpare; cădere
fault = falie; deranjament
faulted = faliat

features, structural = caracteristici structurale
feed = avans; alimentare
field = regiune; teren; câmp; zăcământ
flank = pantă; flancul cutei
flood = inundare
flow = erupţie; curgere; curent
foam = spumă
fold = cută
freezing = solidificare; congelare
friction = frecare
fuel, liquid = combustibil lichid

G

gap = interval; distanţă; gol (lipsă)
gas-bearing = gazifer; purtător de gaze
gas-lift = erupţie artificială; gazlift
grain = granulă
grained, coarse = macrogranular; cu granulaţie mare
gravel = pietriş; grundiş
grind = a sfărâma
ground = pământ; sol
growth = afluenţă; creştere

H

halite = sare gemă; halit
heat = căldură; termic
height = înălţime
hill = deal; colină
hole = gaură de sondă; sondă
hot = cald; fierbinte

I

igneous = eruptiv; vulcanic
impression = impresiune
imprint = amprentă
inch = ţol
induce = a amorsa; a exercita; a provoca; a induce
induration = solidificare; întărire
interbedded = interstratificat
interringle = a amesteca
interstices, capillary = spaţii capilare; goluri capilare
intrusion of water = pătrunderea apei
iron = fier

L

lake = lac; ghiol
land = pământ; teren
lattice = zăbrele; grătar; reţea cristalină
layer = strat
lead = conductor; filon; anticipare; devansare; plumb
length = lungime
level = nivel
lime = var
limestone = calcar
line = linie; conductă
crest line = linie de creastă
load = sarcină; a încărca
lede = filon
loose = liber; în sol; mobil; neconsolidat
loss = pierdere
lower = inferior; a coborâ

M

mantle = manta de protecţie; rocă acoperiş
map = hartă
marginal = marginal
marl = marnă
marsh = baltă
matter, organic = materie organică, substanţă organică
mean = mediu

means of communication = mijloace de comunicaţie
measure = măsură; strat
melting = topire
method = metodă
mine = mină
moisture = umezeală; umiditate
movement = mişcare; avansare
movement of underground waters = avansarea apelor subterane
mud = noroi de foraj

N

network = ţesătură metalică; reţea

O

occur = a exista în natură; a se înmagazina
ore = minereu
clay iron one = sferosiderit
outcrop = efloriment
outer = extern; exterior
cutlining = conturare
output = debit; producţie; randament
overburden = strat protector; strat acoperiş; mort-teren

P

path = cale; drum; traiectorie
pattern = model; formă; gabarit de sonde
pit = puţ; mină
powder = praf; pulbere explozivă
pressure = presiune

Q

quarry = carieră
sand quarry = carieră de nisip
stone quarry = carieră de piatră

R

range = rând; şir; serie
rate = viteză; ritm; valoare
ratio = raţie; coeficient
receiver = seismograf
record = înregistrare; înscriere
recovery = exploatare; extracţie; recuperare
remains = resturi; rămăşiţe
removal = evacuare
replacement = înlocuire; substituire; schimbare
research = cercetare
resin = răşină

S

saddle = şea anticlinală; curmătură
sample = probă
sand = nisip
sand coarse = nisip cu granulaţie mare
sandstone = gresie
scale = scală; crustă; basculă; solz
scatter = a împrăştia; a devia
scour = eroziune; a roda; a spăla
scratch = riz; zgârietură
seam = strat de cărbune; cusătură
search = prospecţiune; exploatare; cercetare
seize = înţepenire
set = rând; şir
settle = a depune, a (se) decanta
shale = argilă şistoasă; şist argilos; marnă
shalow = de mică adâncime; subţire
shane of the pores = forma porilor
share = participaţie
sharp = ascuţit; abrupt
shattering = dislocarea rocii; sfărâmarea rocii

sheet = foaie; schemă; diagramă; pânză
shell = cochilie; scoică
shift = deplasare; migrare
shooting = explodare
shore = coastă; ţărm; litoral
shot = explozie; încărcătură explozivă
silt = nămol; mâl
size = dimensiune; mărime
slate = şist; ardezie
slide = alunecare; alunecare de teren
slip = deplasare; alunecare
slope = înclinare; cădere
smooth = lin; neted
soaked = îmbibat; impregnat
soft = moale
soil = sol; pământ
sound = sunet; a sonda
source = sursă; izvor
space = spaţiu; distanţă
spar = spat
calcareous spar = calcit
fluor spar = fluorină
speed = viteză
spoil = rocă sterilă; a defecta
spring = izvor; sursă; arc; resort
squeezed = presat
stage = treaptă; perioadă; stadiu
steep = mal abrupt; abrupt
step = treaptă; gradat
stone = piatră; piatră (unitate de greutate = 6,35 kg)
stone, lode = magnetit
storage = depozit; depozitare; stocaj
store = depozit; depozitare
storm, magnetic = furtună magnetică
stream = curent; curgere
strength = rezistenţă
stress = tensiune; efort
stretch = întindere; alungire
supply = alimentare
survey = ridicare geologică; ridicare topografică

T

test = probă; încercare; determinare
thick = puternic; gros
thin = a dilua; diluat
tide = aflux-reflux; maree
tin = cositor
ton = tonă
tool = sculă; unealtă
top = acoperiş; vârf; creastă
trace = urmă; drum

U

underflow = curent subteran
underground = subsol; subteran
underlay = a zace sub
underlayer = strat-culcuş; strat inferior
uplift = ridicare
upright = vertical; montant

V

valley = vale
anticlinal valley = vale anticlinală
valuation = evaluare; estimare
value = valoare; mărime
vein = filon
vent = coş vulcanic; supapă de răsuflare
void = vid; gol

W

wash = spălare; eroziune; aluviune
water = apă
connate water = apă veterică; apă fosilă
shallow water = apă mică
wave = undă

weathering, rock = alterarea rocilor
weight = greutate
wet = umed; hidrofil
whirl = vârtej; turbion; mişcare turbionară
wind = vânt
work = lucru (mecanic); fabrică
research work = muncă de cercetare; cercetări

Y

yard = iard=0.9144 m
yield = fluaj; producţie

Z

zone = zonă
zone of folding = zonă de cutare
zone of saturation = zonă de saturaţie

Tiparul s-a efectual sub c-da nr. 120/1994 la
Tipografia Editurii Universităţii Bucureşti

ISBN 973-575-040-6

Lei 280